2000 International Energy Conservation Code

Using

MECcheck™

U.S. Department of Energy

Produced by the Pacific Northwest National Laboratory

Version 3.3 – September 2002

MECcheck™ 2000 IECC

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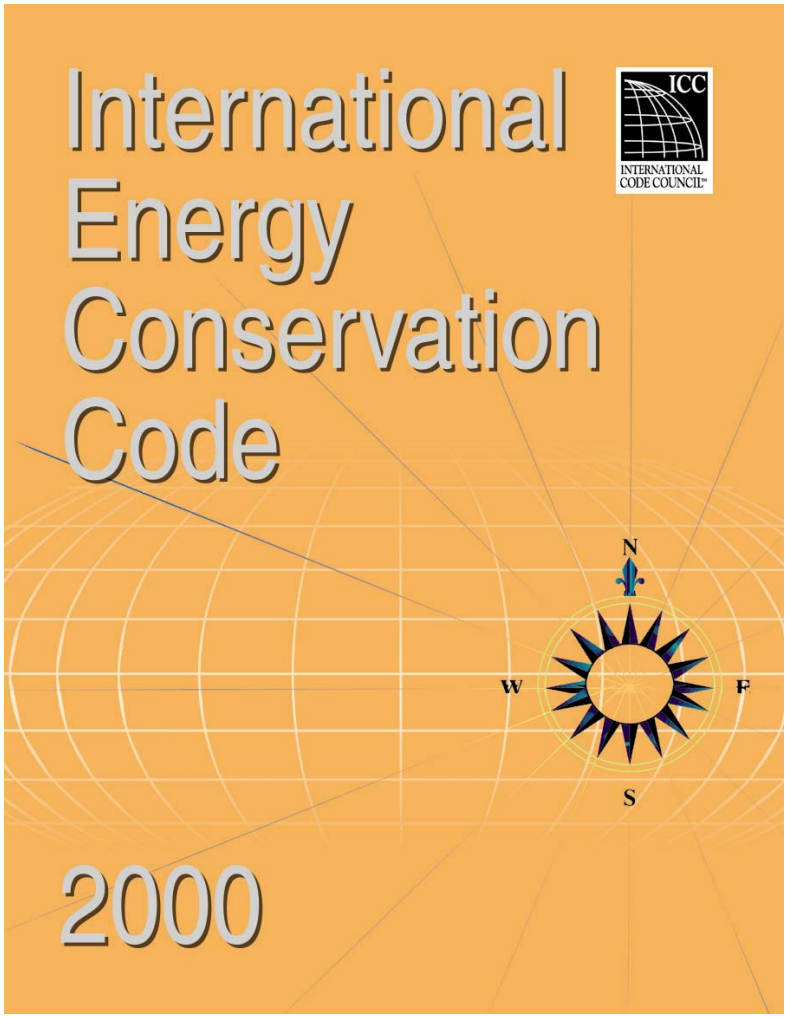
Class Structure

- Overview of IECC
- Introduction to MEC*check*
- Basic Requirements
- Insulation and Window Requirements
  - Prescriptive Packages
  - Software
  - Trade-Off Worksheet
- Plan Review
- Field Inspection

What is the IECC?



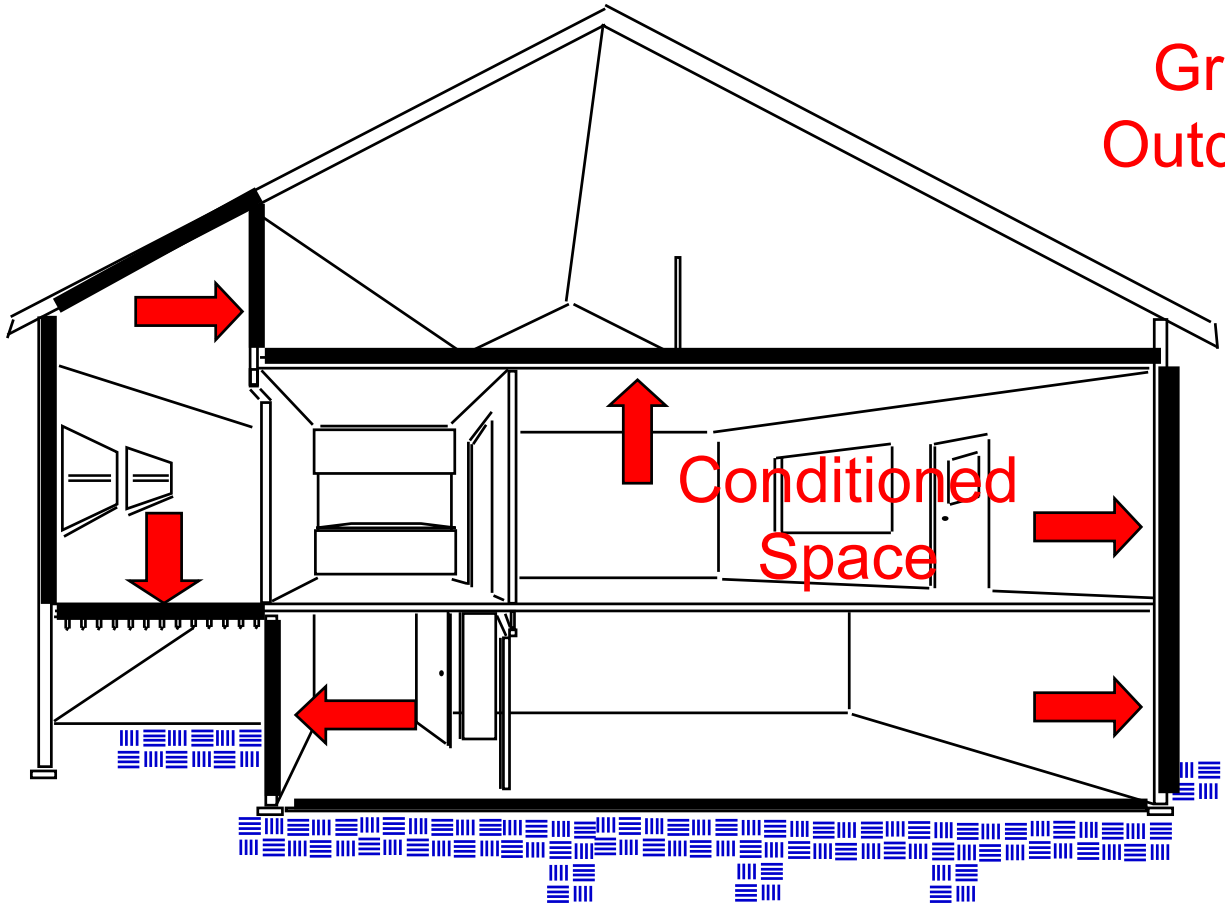
A REQUIRED MINIMUM LEVEL OF ENERGY EFFICIENCY IN NEW RESIDENTIAL CONSTRUCTION

MECcheck™
2000 IECC

Structure of the IECC

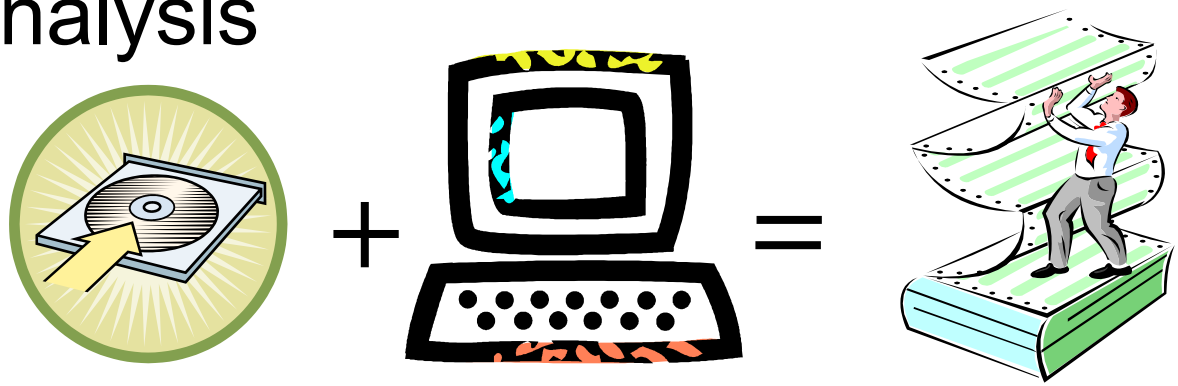
- Chapter 1 - Administration and Enforcement
- Chapter 2 - Definitions
- Chapter 3 - Design Conditions
- Chapter 4 - “Systems Analysis”
- Chapter 5 - “Component Performance”
- Chapter 6 - “Prescriptive Requirements”
- Chapter 7 - Building Design for all Commercial Buildings
- Chapter 8 - Design by Acceptable Practice
- Chapter 9 - Referenced Standards

Heat Loss Across Building Envelope



Chapter 4 - Systems Analysis

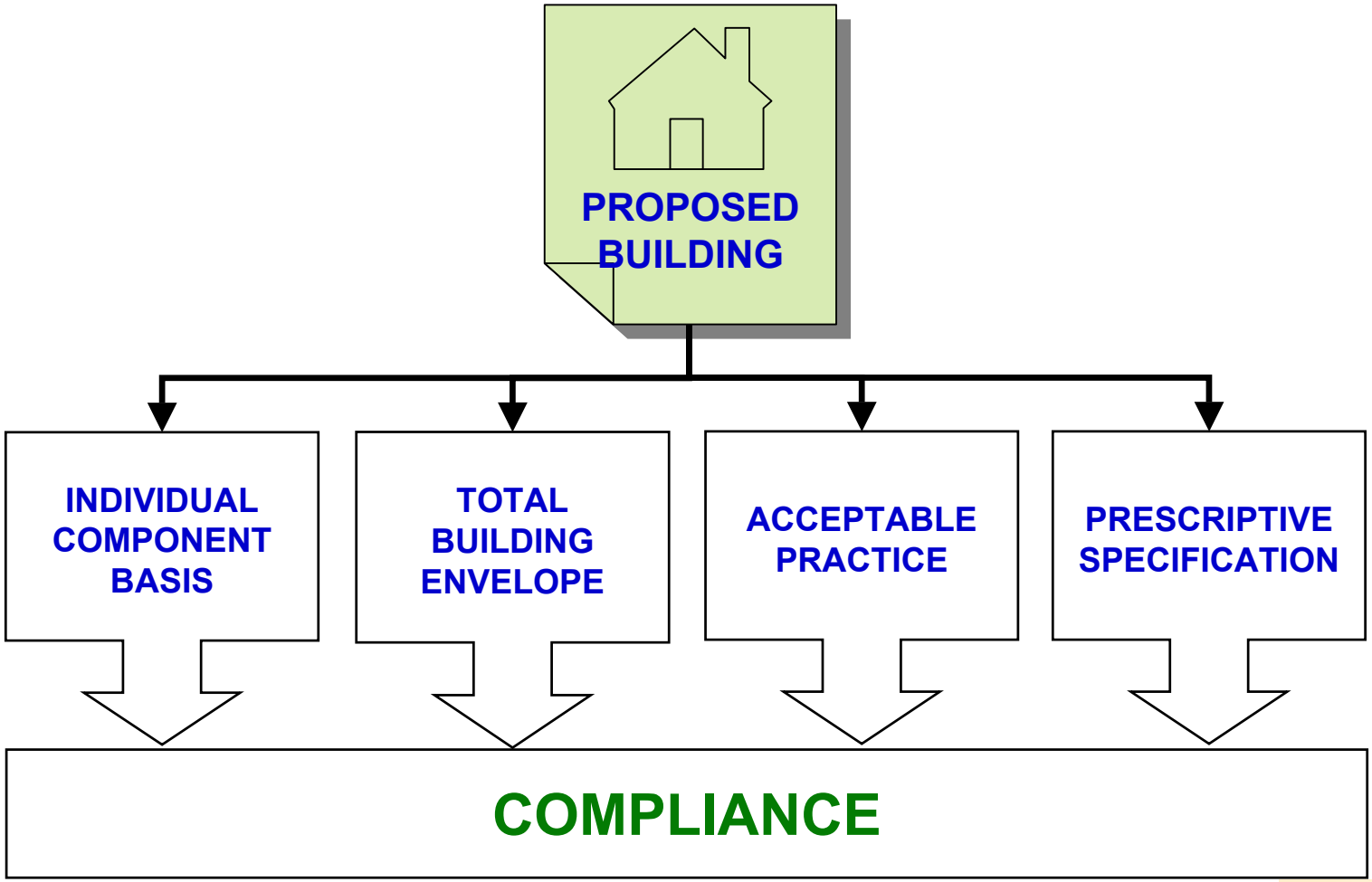
- Hourly annual energy use simulation to demonstrate that the proposed building uses equal or less energy compared to a “standard” building
- Usually done through complex software analysis



Chapter 4 - Systems Analysis

- Energy for renewable (non-depletable) sources does not count
- Includes credit for renewable energy

Chapter 5: Component Performance

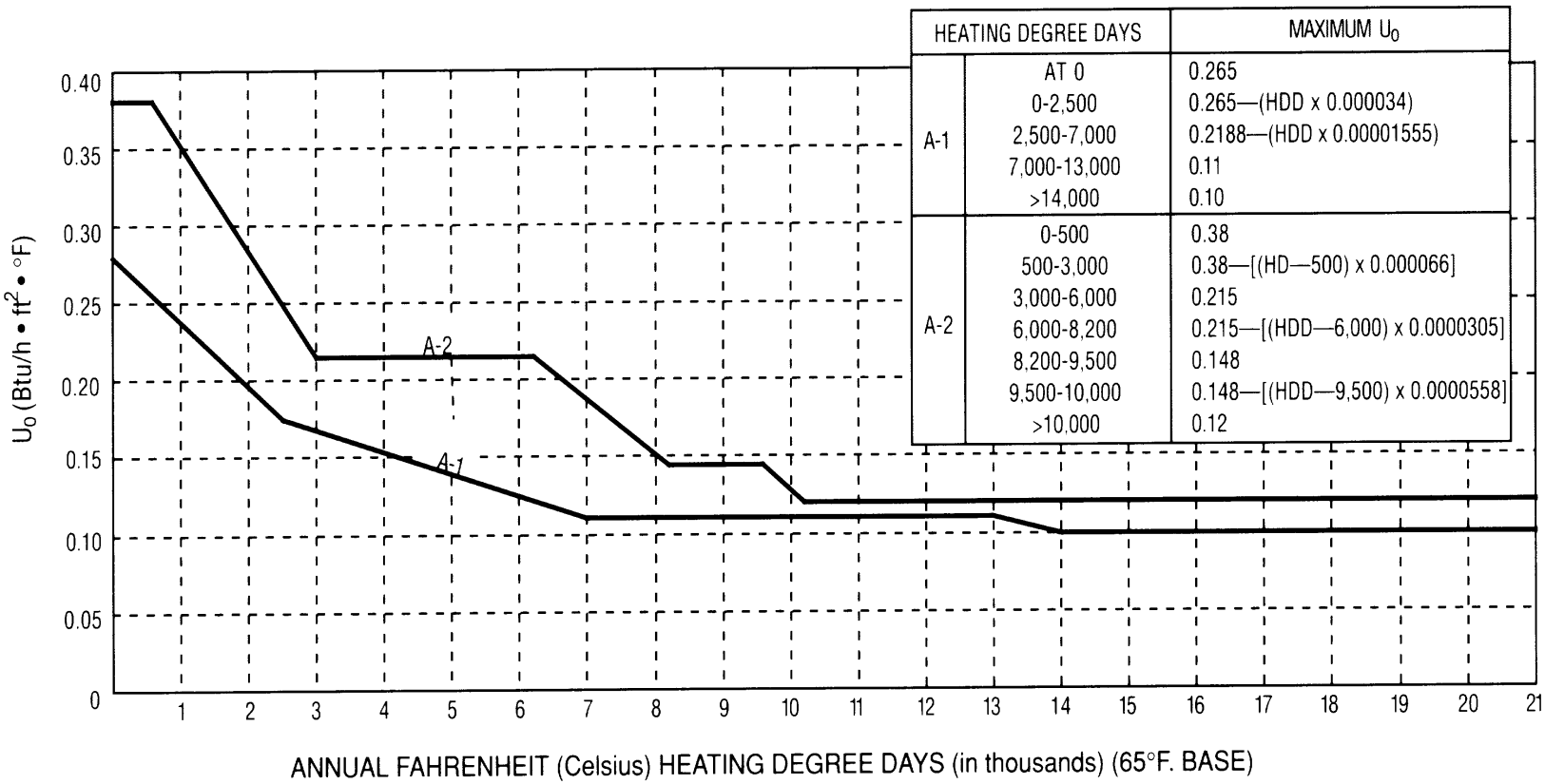


Thermal Envelope

- Sets U-value or R-value requirements based upon:
  - Heating degree days
  - Building component (ceilings, walls, floors, windows, doors, ducts and slab)
- Sets minimum efficiency requirements for other features that use energy

FIGURE 1

U_o WALLS—GROUP R BUILDINGS—HEATING



	HEATING DEGREE DAYS	MAXIMUM U_o
A-1	AT 0	0.265
	0-2,500	0.265—(HDD x 0.000034)
	2,500-7,000	0.2188—(HDD x 0.00001555)
	7,000-13,000	0.11
	>14,000	0.10
A-2	0-500	0.38
	500-3,000	0.38—[(HD—500) x 0.000066]
	3,000-6,000	0.215
	6,000-8,200	0.215—[(HDD—6,000) x 0.0000305]
	8,200-9,500	0.148
	9,500-10,000	0.148—[(HDD—9,500) x 0.0000558]
	>10,000	0.12

For **SI:** 1 Btu/h·ft.^{2}·°F. = 5.678 W/(m^2·k), °F. = 1.8°C. + 32.

TABLE 502.2.4(3)
PRESCRIPTIVE BUILDING ENVELOPE REQUIREMENTS, TYPE A-1 RESIDENTIAL BUILDINGS
WINDOW AREA 15 PERCENT OF GROSS EXTERIOR WALL AREA

HEATING DEGREE DAYS	MAXIMUM	MINIMUM					
	Glazing *U*-factor	Ceiling *R*-value	Exterior wall *R*-value	Floor *R*-value	Basement wall *R*-value	Slab perimeter *R*-value and depth	Crawl space wall *R*-value
0-499	any	R-13	R-11	R-11	R-0	R-0	R-0
500-999	0.90	R-19	R-11	R-11	R-0	R-0	R-4
1,000-1,499	0.75	R-19	R-11	R-11	R-0	R-0	R-5
1,500-1,999	0.75	R-26	R-13	R-11	R-5	R-0	R-5
2,000-2,499	0.65	R-30	R-13	R-11	R-5	R-0	R-6
2,500-2,999	0.60	R-30	R-13	R-19	R-6	R-4, 2 ft.	R-7
3,000-3,499	0.55	R-30	R-13	R-19	R-7	R-4, 2 ft.	R-8
3,500-3,999	0.50	R-30	R-13	R-19	R-8	R-5, 2 ft.	R-10
4,000-4,499	0.45	R-38	R-13	R-19	R-8	R-5, 2 ft.	R-11
4,500-4,999	0.45	R-38	R-16	R-19	R-9	R-6, 2 ft.	R-17
5,000-5,499	0.45	R-38	R-18	R-19	R-9	R-6, 2 ft.	R-17
5,500-5,999	0.40	R-38	R-18	R-21	R-10	R-9, 2 ft.	R-19
6,000-6,499	0.35	R-38	R-18	R-21	R-10	R-9, 4 ft.	R-20
6,500-6,999	0.35	R-49	R-21	R-21	R-11	R-11, 4 ft.	R-20
7,000-8,499	0.35	R-49	R-21	R-21	R-11	R-13, 4 ft.	R-20
8,500-8,999	0.35	R-49	R-21	R-21	R-18	R-14, 4 ft.	R-20
9,000-12,999	0.35	R-49	R-21	R-21	R-19	R-18, 4 ft.	R-20

For SI: 1 foot = 304.8 mm.

Chapter 6: Simplified Prescriptive

- Residential Buildings, Type A-1
  - Glazing must be less than 15% of gross wall area
  - Must meet requirements of Chapters 4 and 5
- Residential Buildings, Type A-2
  - Glazing must be less than 25% of gross wall area
  - Must meet requirements of Chapters 4 and 5
- Climates > 13,000 HDD must use envelope requirements of Chapters 4 and 5

TABLE 602.1
SIMPLIFIED PRESCRIPTIVE BUILDING ENVELOPE THERMAL COMPONENT CRITERIA
MINIMUM REQUIRED THERMAL PERFORMANCE (*U*-FACTOR AND *R*-VALUE)

HEATING DEGREE DAYS	Maximum	Minimum					
	Glazing *U*-factor	Ceiling *R*-value	Wall *R*-value	Floor *R*-value	Basement wall *R*-value	Slab perimeter *R*-value and depth	Crawl space wall *R*-value
0-499	Any	R-13	R-11	R-11	R-0	R-0	R-0
500-999	0.90	R-19	R-11	R-11	R-0	R-0	R-4
1,000-1,499	0.75	R-19	R-11	R-11	R-0	R-0	R-5
1,500-1,999	0.75	R-26	R-13	R-11	R-5	R-0	R-5
2,000-2,499	0.65	R-30	R-13	R-11	R-5	R-0	R-6
2,500-2,999	0.60	R-30	R-13	R-19	R-6	R-4, 2 ft.	R-7
3,000-3,499	0.55	R-30	R-13	R-19	R-7	R-4, 2ft.	R-8
3,500-3,999	0.50	R-30	R-13	R-19	R-8	R-5, 2 ft.	R-10
4,000-4,499	0.45	R-38	R-13	R-19	R-8	R-5, 2 ft.	R-11
4,500-4,999	0.45	R-38	R-16	R-19	R-9	R-6, 2 ft.	R-17
5,000-5,499	0.45	R-38	R-18	R-19	R-9	R-6, 2 ft.	R-17
5,500-5,999	0.40	R-38	R-18	R-21	R-10	R-9, 4 ft.	R-19
6,000-6,499	0.35	R-38	R-18	R-21	R-10	R-9, 4 ft.	R-20
6,500-6,999	0.35	R-49	R-21	R-21	R-11	R-11, 4 ft.	R-20
7,000-8,499	0.35	R-49	R-21	R-21	R-11	R-13, 4 ft.	R-20
8,500-8,999	0.35	R-49	R-21	R-21	R-18	R-14, 4 ft.	R-20
9,000-12,999	0.35	R-49	R-21	R-21	R-19	R-18, 4 ft.	R-20

For SI: 1 foot = 304.8 mm.

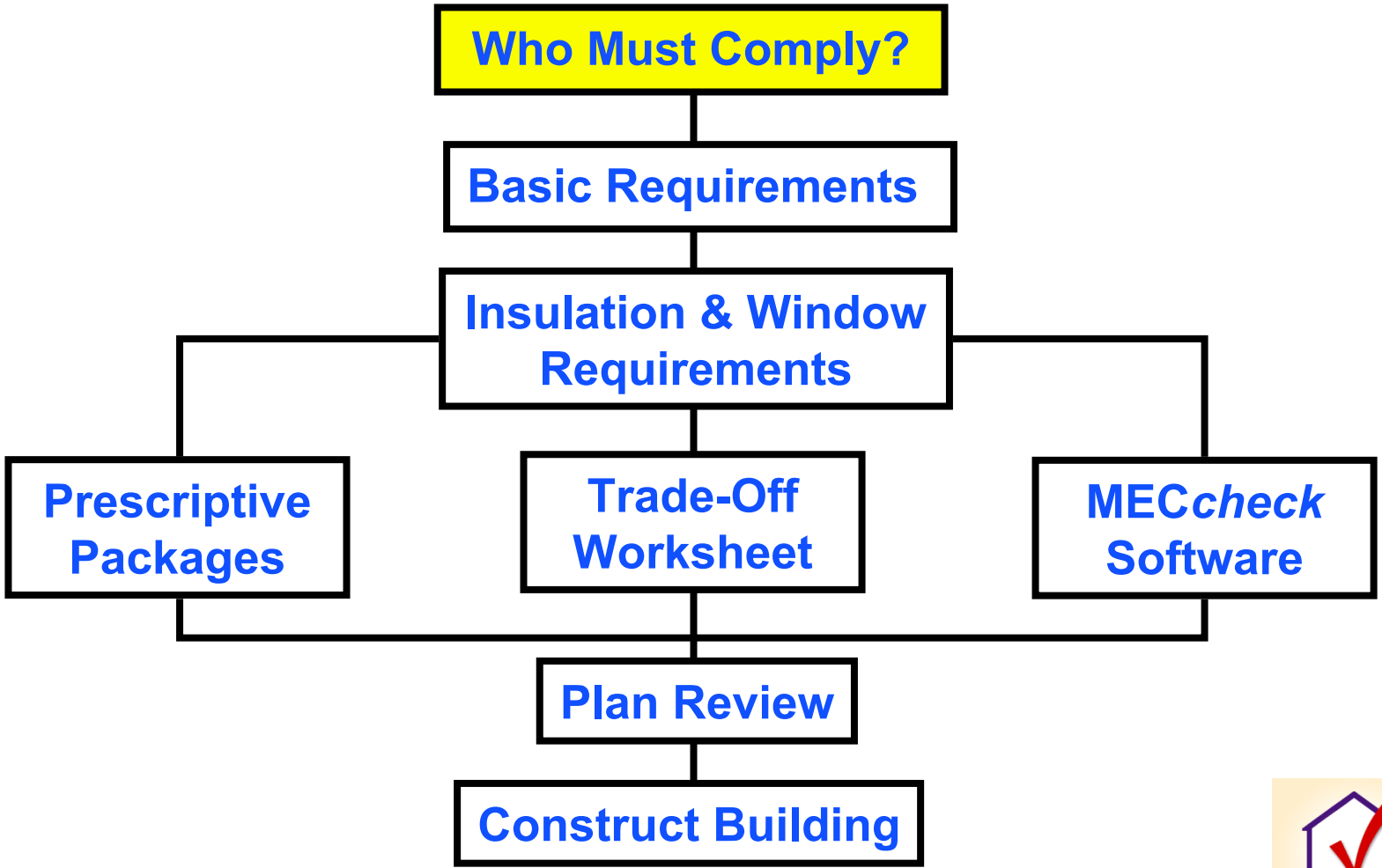
MEC*check*™ Manual

- Self-contained
  - IECC “yellow book” not needed
  - References interpreted

MEC*check*™ Manual Outline

- Overview
- Basic requirements
- Insulation and glazing requirements
  - Prescriptive packages, or
  - Trade-off worksheet, or
  - Software
- Plan check
- Field inspection

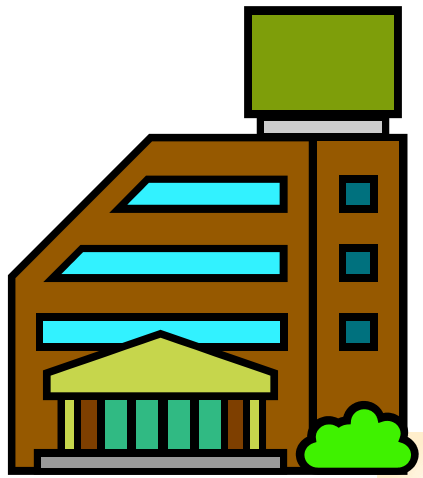
Compliance Path



What Types of Buildings Must Comply?

One- and two-family

Multifamily, 3 stories or less



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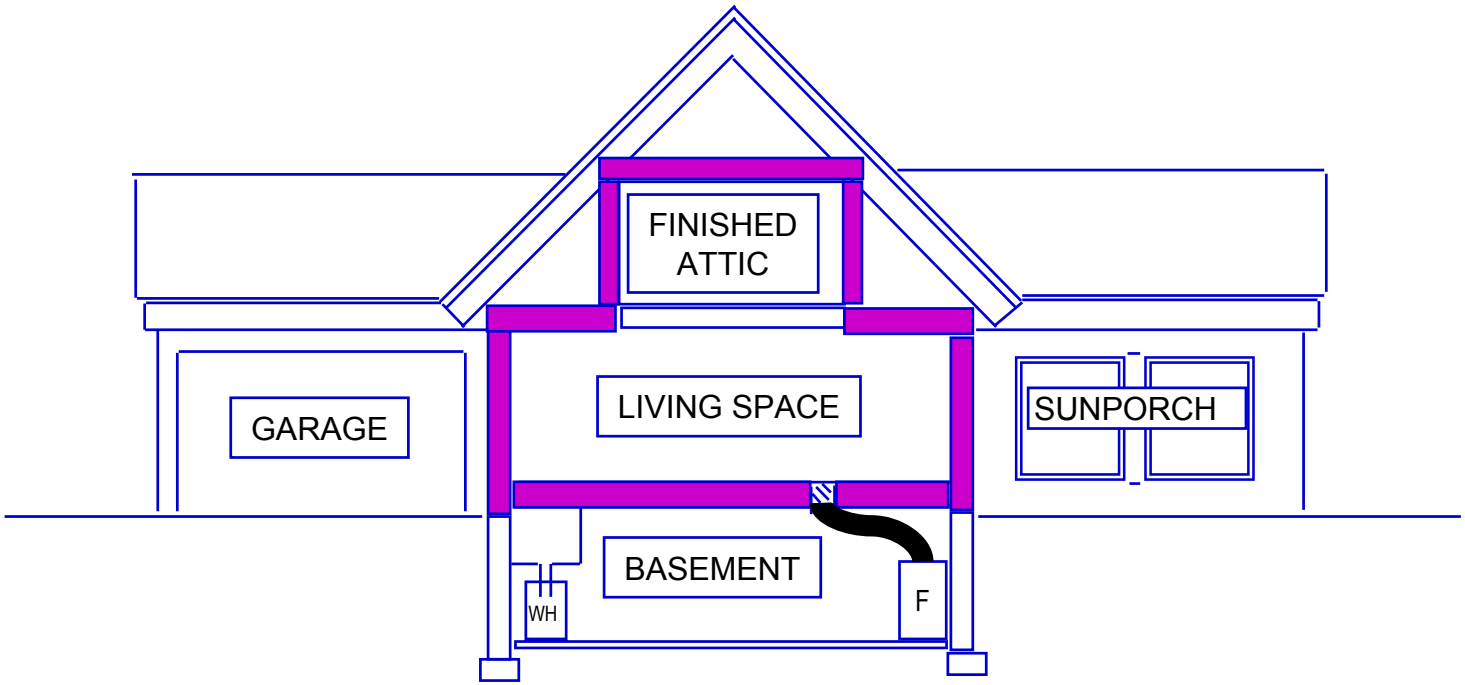
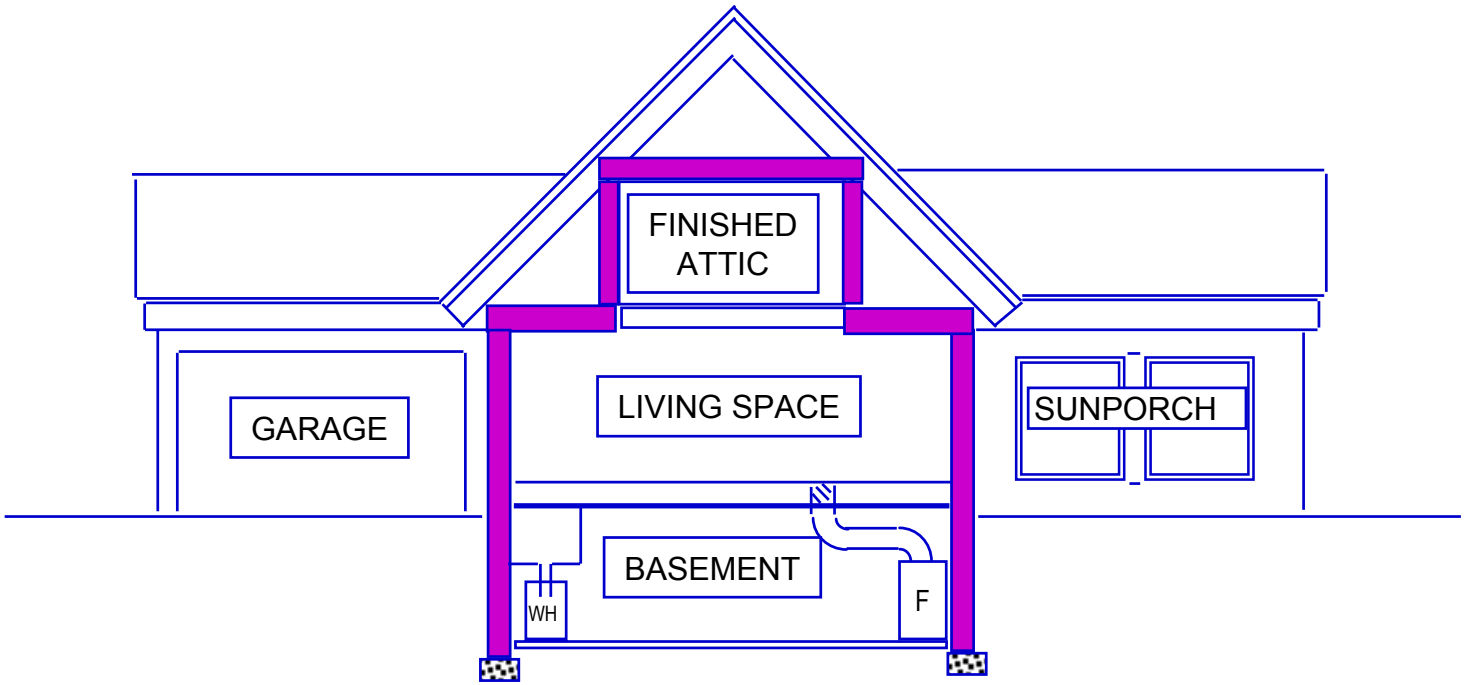
Areas of the Building that Must Comply

- New construction
- Heated and cooled space
  - Temperatures within the space are 50ºF or higher (heating) 85ºF or lower (cooling) during normal operation
  - Heated and/or cooled air (positive supply)
  - Uninsulated surfaces located within space

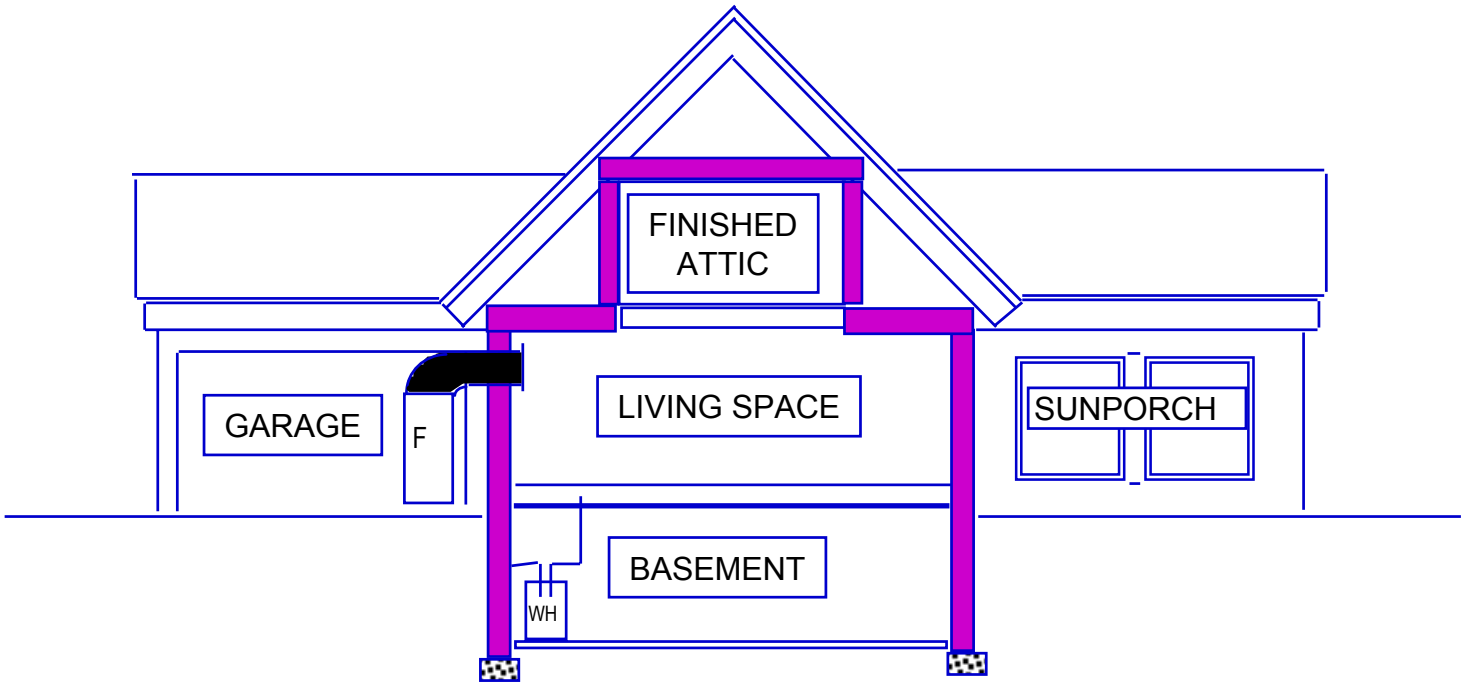
Conditioned Space – Case 1



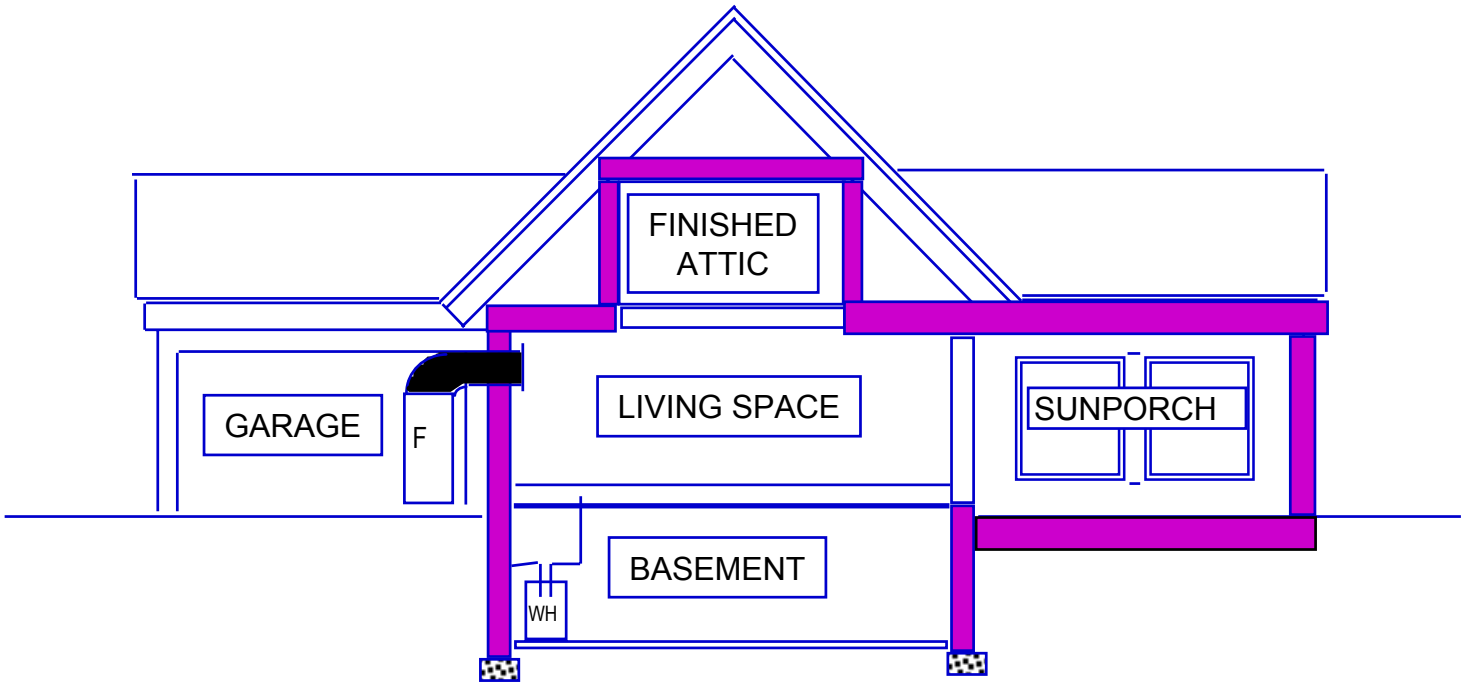
Conditioned Space - Case 2



Conditioned Space - Case 3



Conditioned Space - Case 4



Conditioned Space Problem

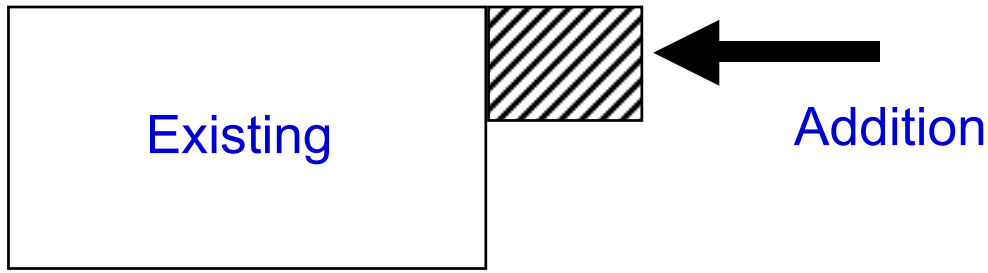
- 1st Case
  - Furnace in basement/floor over basement insulated/ducts insulated
- 2nd Case
  - No insulation in floor over basement/ducts uninsulated
- 3rd Case
  - Furnace in garage - common wall insulated/ducts insulated
- 4th Case
  - Furnace in garage - common wall between living and sunporch uninsulated/ceiling and walls of sunporch insulated

Buildings Exempt from the IECC

- No heating or cooling
- Historical
- Low peak energy <u>for all purposes</u>
  - < 3.4 Btu/hr/ft^2 of floor area
  - < 1.0 W/ft^2 of floor area

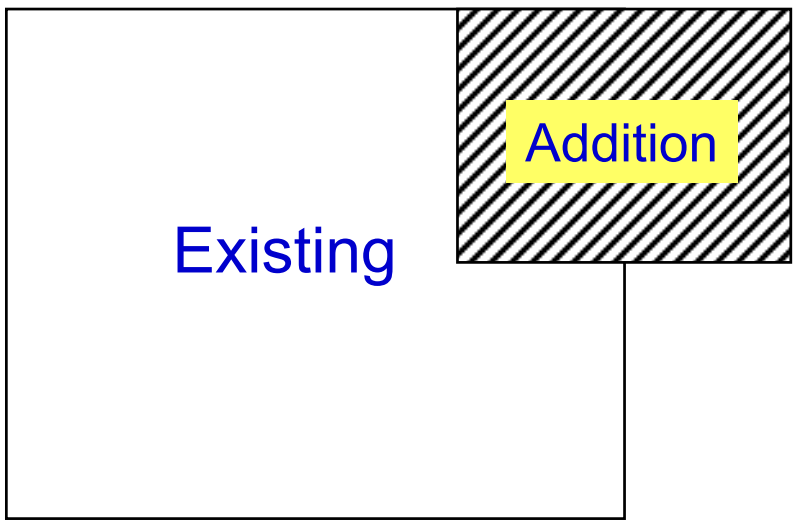
Other Conditions

- Additions



- Mixed Occupancy
  - Major occupancy > 90% of floor area of any floor in building.

Problem:



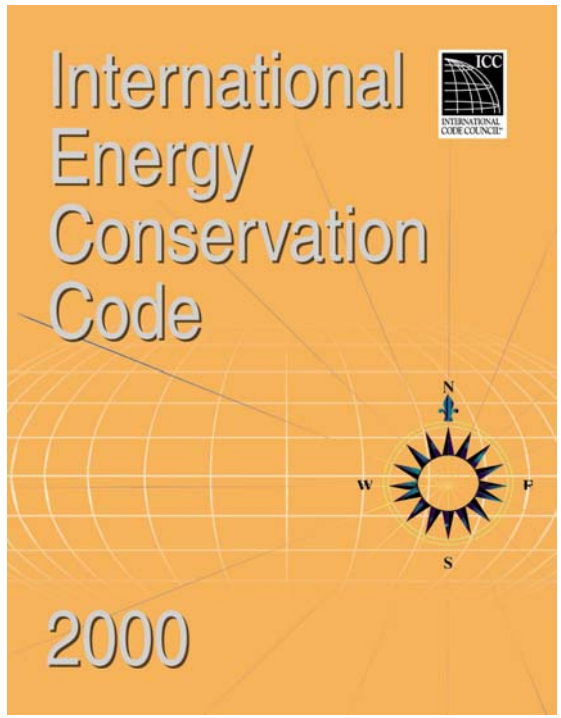
- What must comply with the IECC if the addition includes:
  - New ducts from existing system
  - Wood stove
  - Windows
  - Walls, ceiling, floor

Precedence

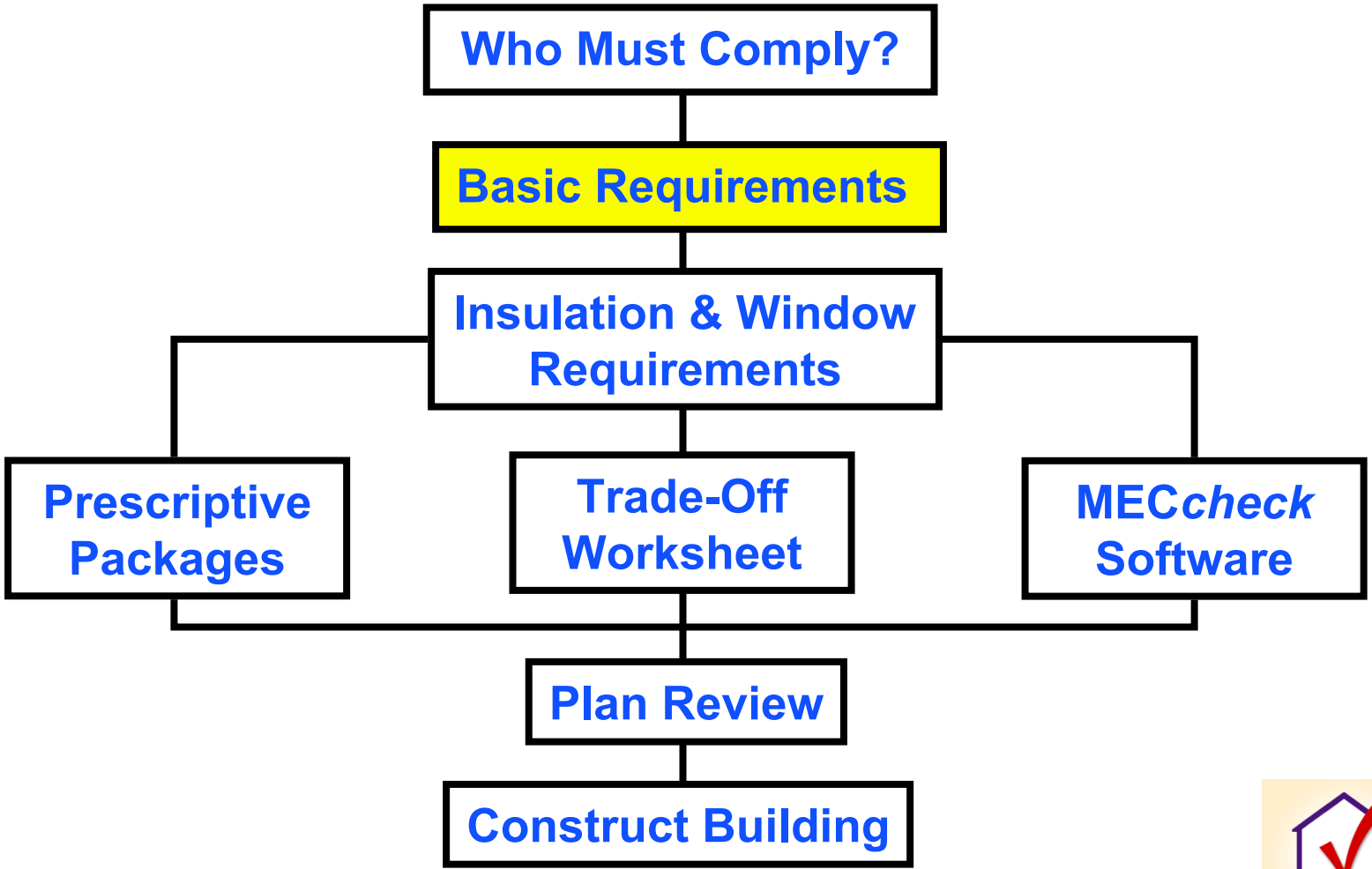
1st

Life, Health, Safety and Environment

2nd



Compliance Path



- Air Leakage
- Vapor Retarders
- Materials and Equipment Information
- Heating and Cooling Equipment Efficiencies
- Duct Insulation
- Duct Construction
- Temperature Controls
- HVAC Piping Insulation
- Swimming Pools
- Circulating Service Hot Water Systems
- Electrical

Air Leakage

Vapor Retarders

Materials and Equipment Information

Heating and Cooling Equipment Efficiencies

Duct Insulation

Duct Construction

Temperature Controls

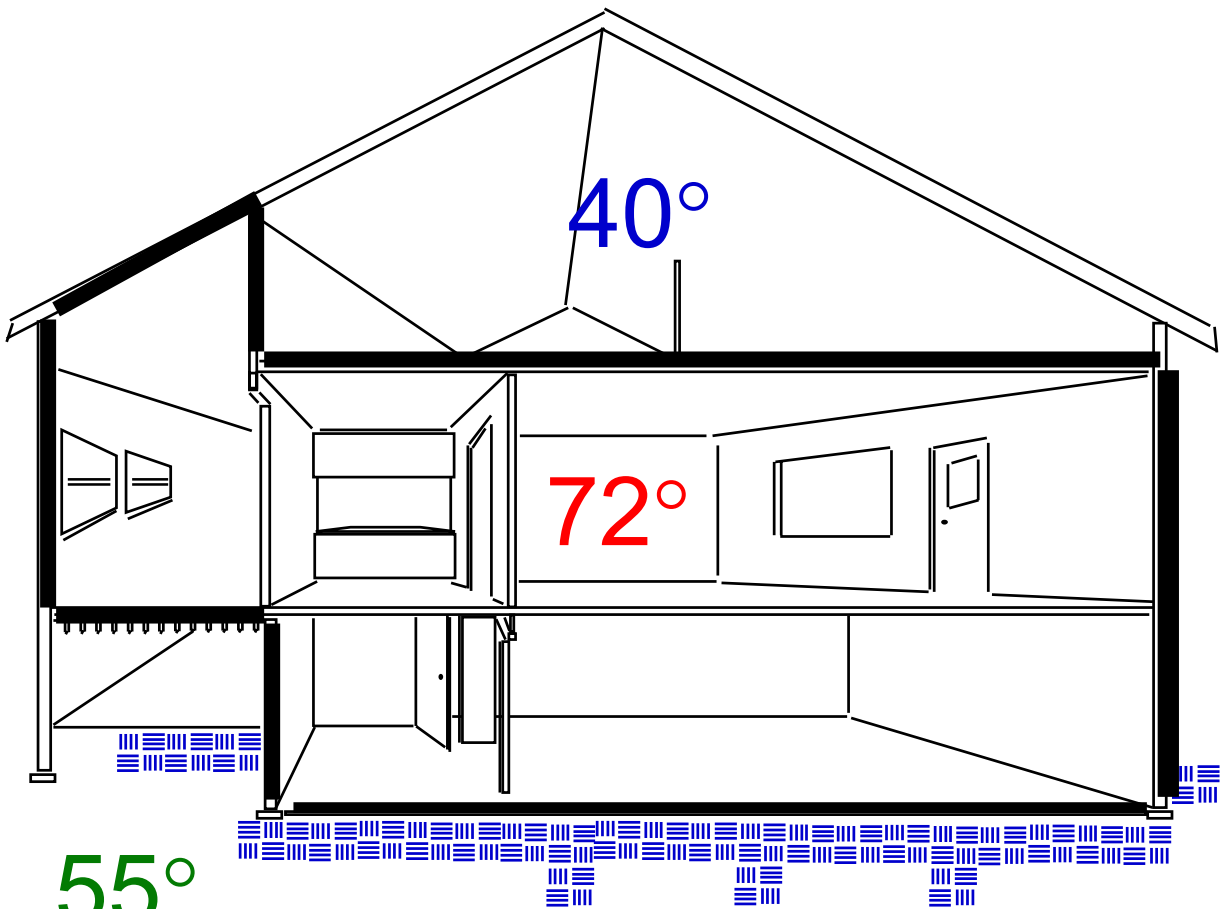
HVAC Piping Insulation

Swimming Pools

Circulating Service Hot Water Systems

Electrical

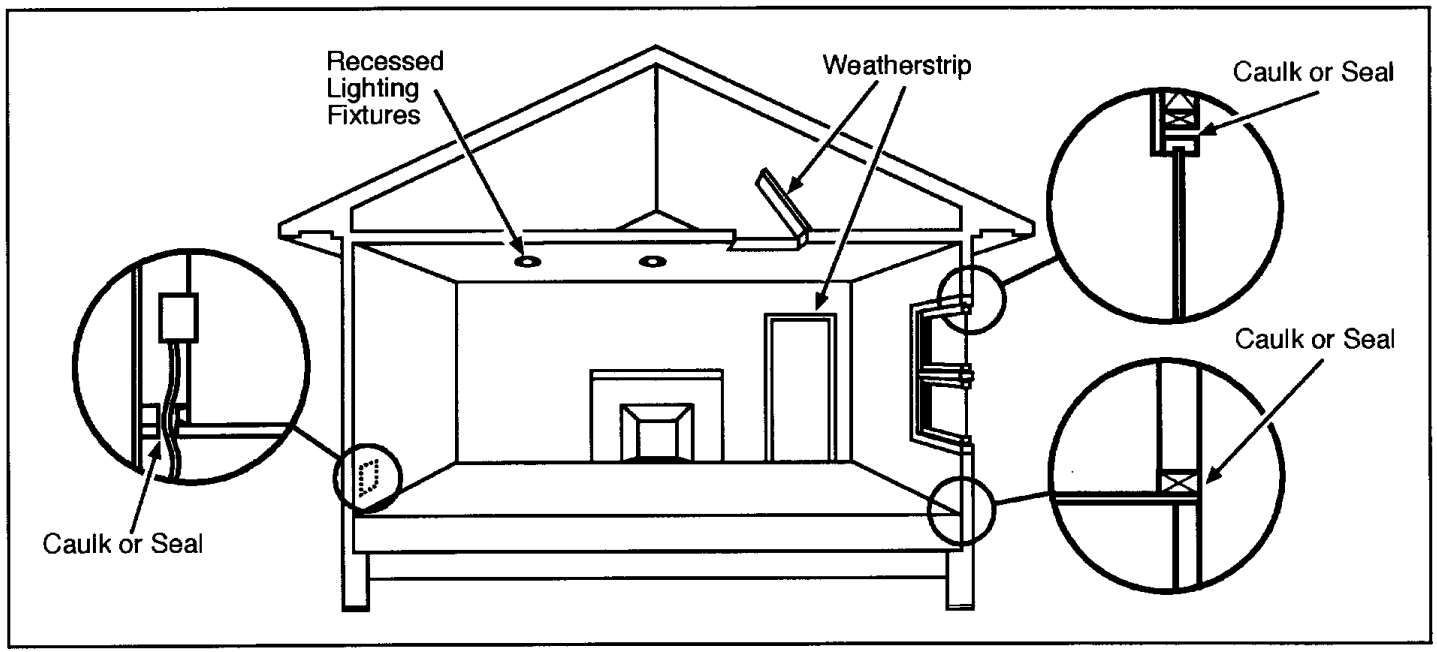
Envelope



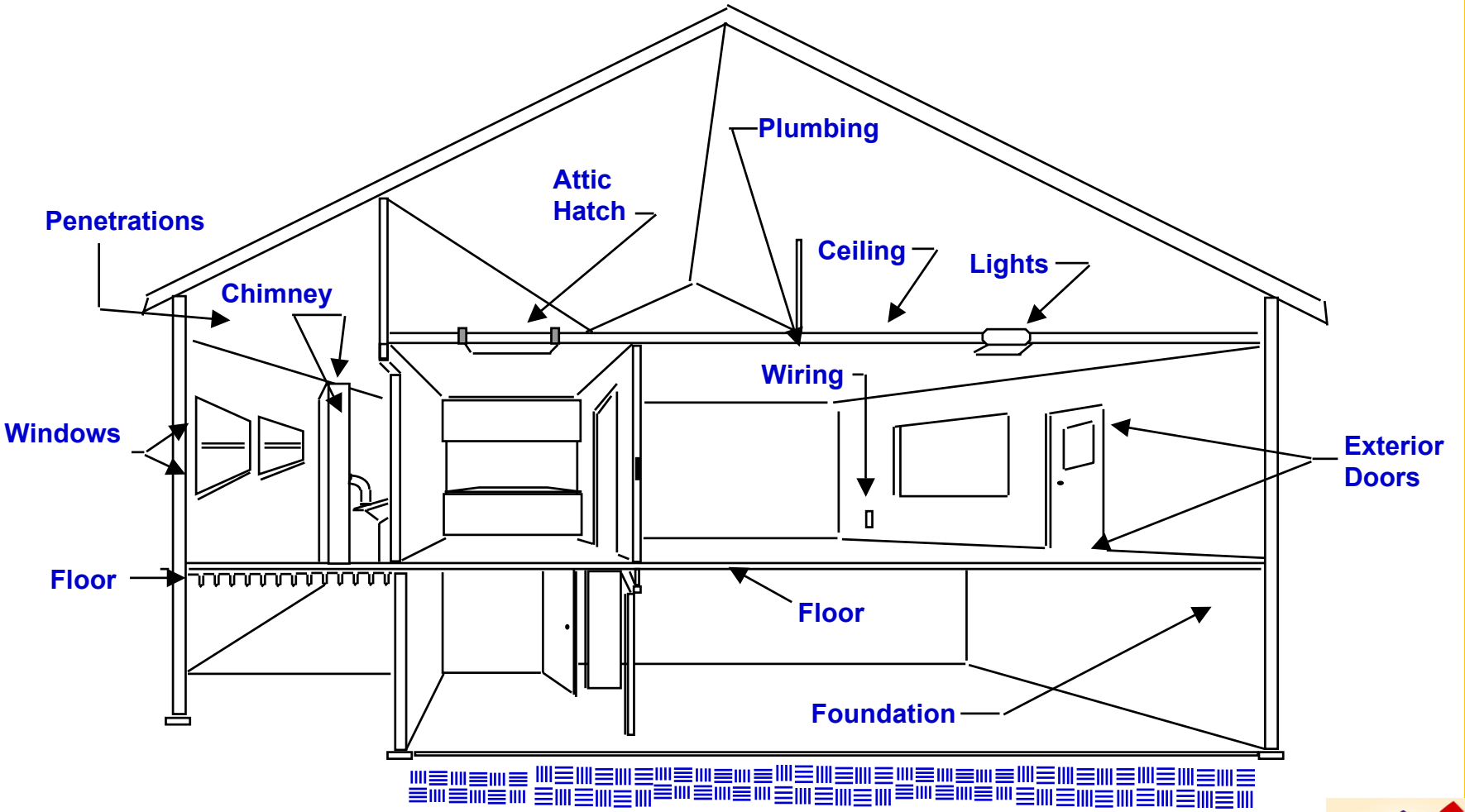
Basic Requirements

Infiltration Controls

- Seal all joints, penetrations and other such openings in the building envelope



Infiltration Points



Typical Sources of Air Leakage in the Home

Infiltration Controls

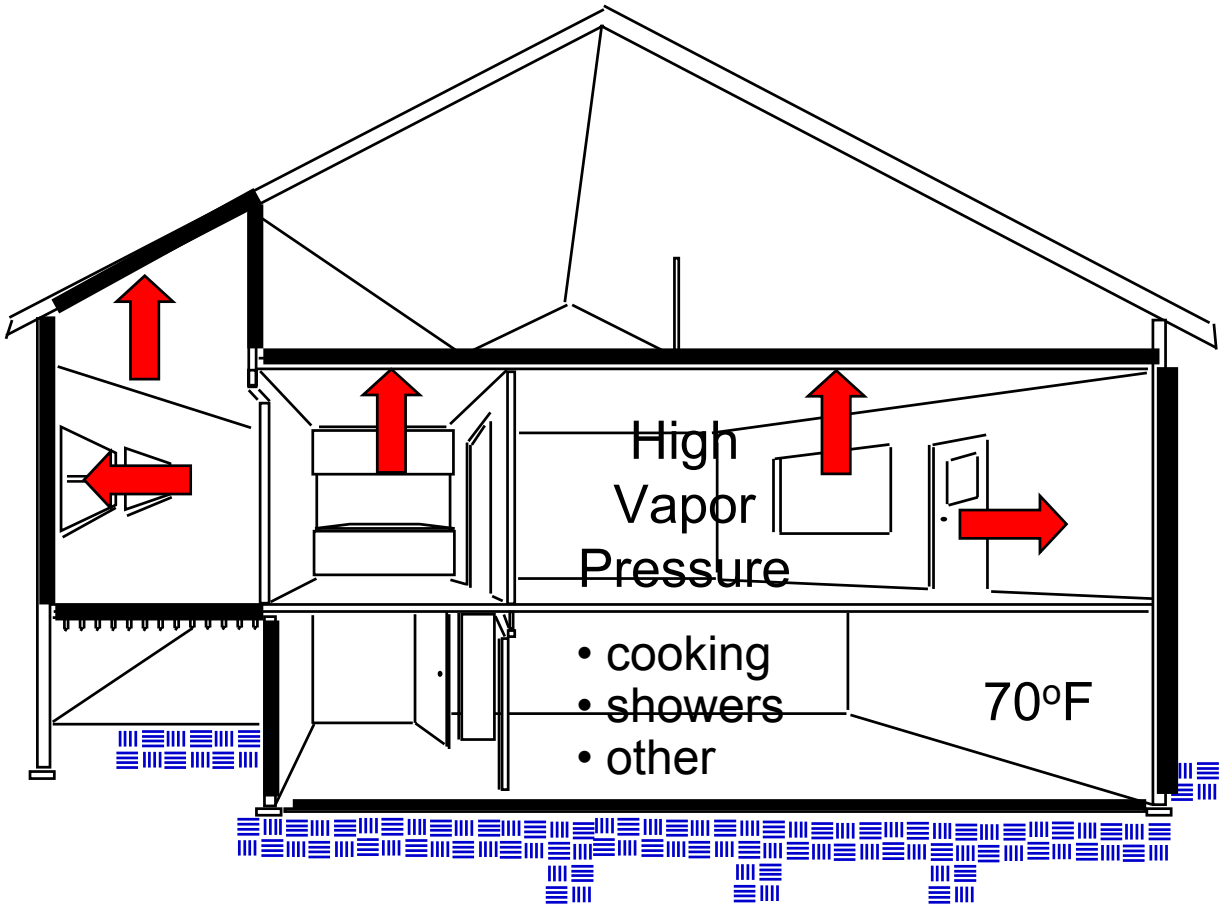
Infiltration Controls

Infiltration Controls

Before

After

Vapor Pressure

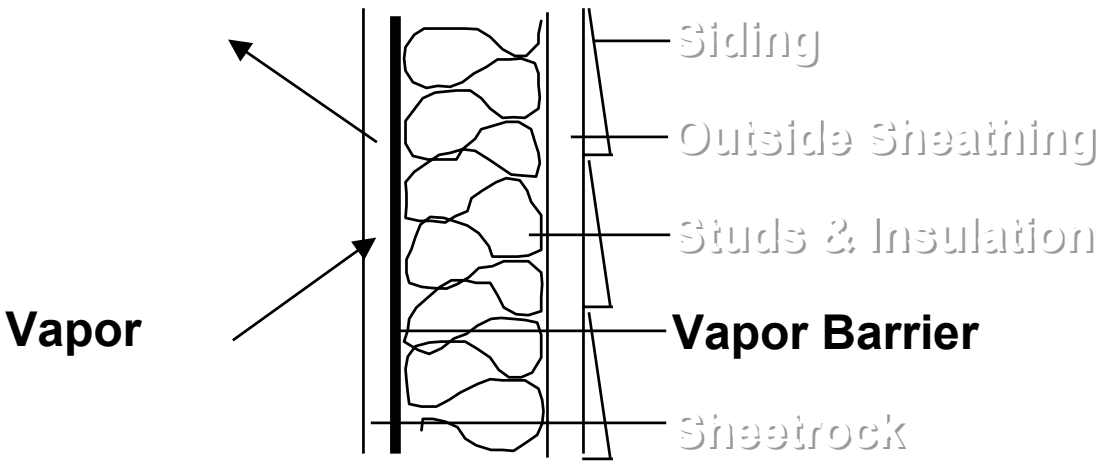


20°F

Low
Vapor
Pressure

Basic Requirements

- Vapor retarders
  - Install on “warm-in-winter side” of insulation
  - Use in unvented framed walls, floors, and ceilings
  - Must have Perm rating of ≤ 1.0 per ASTM E96-80
  - Exceptions



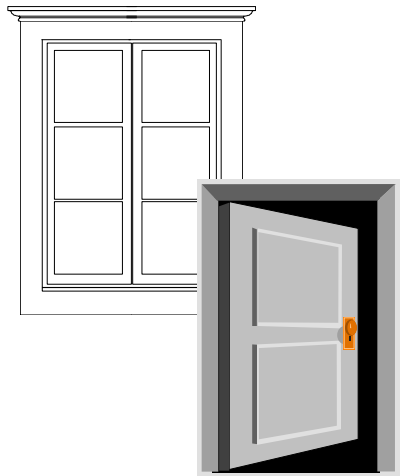
Vapor Retarders

Basic Requirements

- Materials identification
  - Show sufficient detail on plans or specifications to indicate conformance with the requirements of the code
  - EXAMPLES - call out:
    - envelope insulation levels
    - duct insulation levels
    - high efficiency heating equipment

Other Requirements

- Manufactured window and door infiltration rates
- Site-built window and door infiltration control
- Locations with HDD < 3500
  - Combined SHGC must be < 0.4
- Recessed lighting fixtures



Air Leakage

Vapor Retarders

Materials and Equipment information

Heating and Cooling Equipment Efficiencies

Duct Insulation

Duct Construction

Temperature Controls

HVAC Piping Insulation

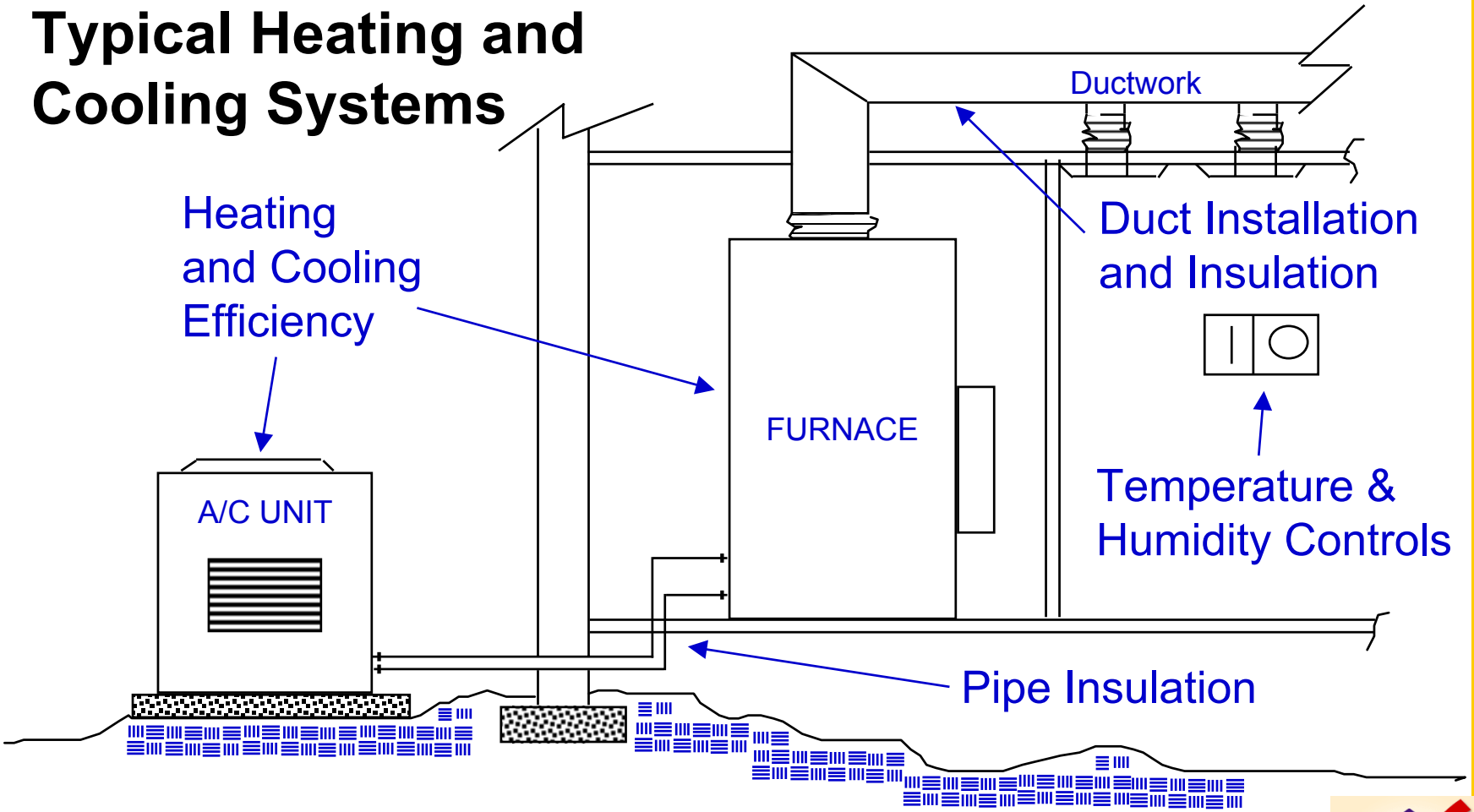
Swimming Pools

Circulating Service Hot Water Systems

Electrical

HVAC Systems

Typical Heating and Cooling Systems



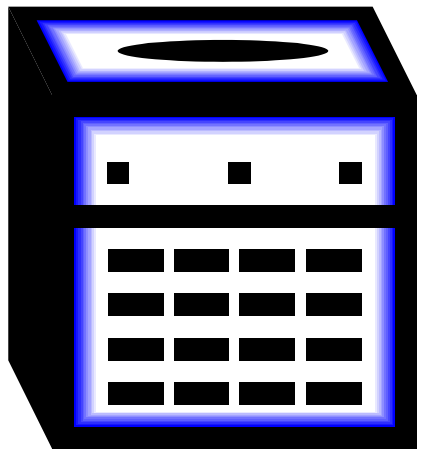
HVAC Systems

(MPG) - Miles Per Gallon

- Heating and cooling efficiency terminology
  - (AFUE) - Annual Fuel Utilization Efficiency
  - (HSPF) - Heating Seasonal Performance Factor
  - (SEER) - Seasonal Energy Efficiency Ratio

HVAC Efficiency Requirements

- Pre-empted by the National Appliance Energy Conservation Act (NAECA)
- Applies to heating and cooling and water heating systems



Residential Heating and Cooling Equipment Efficiency

TABLE 503.2 MINIMUM EQUIPMENT PERFORMANCE			
EQUIPMENTCATEGORY	**SUB-CATEGORY**	**REFERENCED STANDARD**	**MINIMUM PERFORMANCE**
Air-cooled heat pumps heating mode <65,000 Btu/h cooling capacity	Split systems Single Package	ARI 210/240	6.8 HSPF 6.6 H.S.P.F
Gas-fired or oil fired furnace < 225,000 Btu/h		DOE 10 CFR Part 430, Subpart B, Appendix N	AFUE 78% Et 80%
Gas-fired or oil fired steam and hot-water boilers < 300,000 Btu/h		DOE 10 CFR Part 430, Subpart B, Appendix N	AFUE 80%
Air-cooled air conditioners and heat pumps cooling mode < 65,000 Btu/h cooling capacity	Split systems Single Package	ARI 210/240	10.0 SEER 9.7 SEER

Duct Insulation Requirements

	Insulation R-values (h•ft²•°F)/Btu[d]			
	Ducts in unconditioned attics or outside building		Ducts in unconditioned basements, crawl spaces, garages and other unconditioned spaces[c]	
	Supply	Return	Supply	Return[b]
Annual Heating Degree Days				
Below 1,500	8	4	4	0
1,500 to 3,500	8	4	6	2
3,501 to 7,500	8	4	8	2
Above 7,500	11	6	11	2

HVAC Duct Insulation

Other Requirements

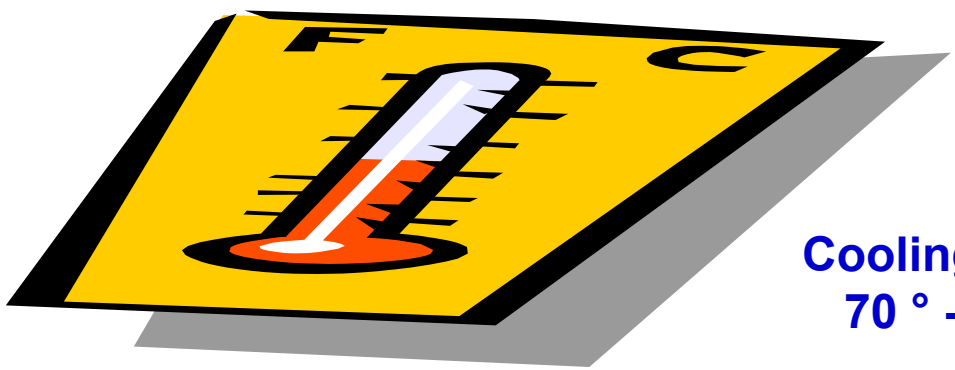
- Duct installation/sealing
  - Low-pressure supply and return ducts sealed using mastic with fibrous backing tape
  - Mechanical Code of local jurisdiction

Duct Systems - Air Sealing

HVAC Systems

- One thermostat per system
  - Adjustable
  - Temperature ranges

Heating & Cooling
55 ° - 85 °



Heating Only
55 ° - 75 °

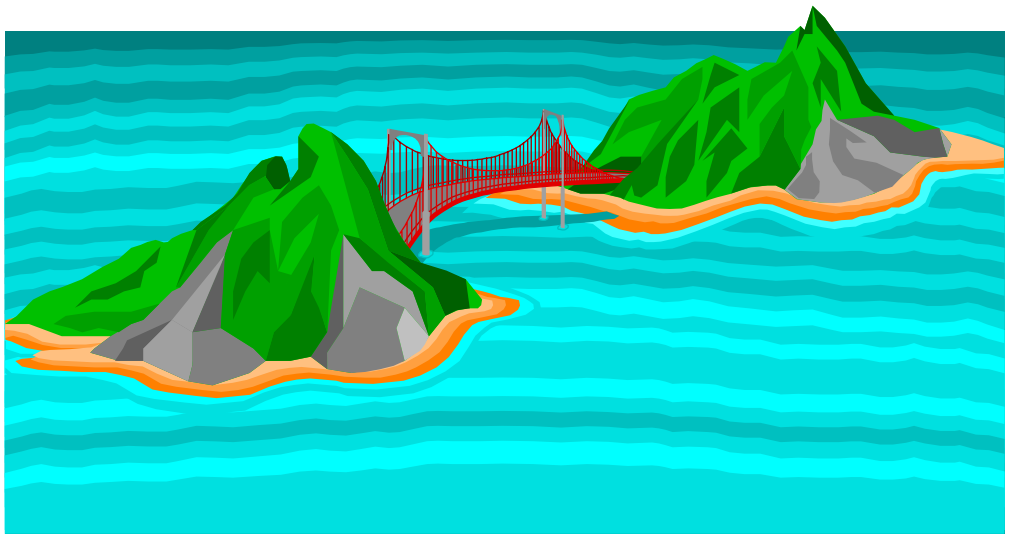
Cooling Only
70 ° - 85 °

HVAC Systems

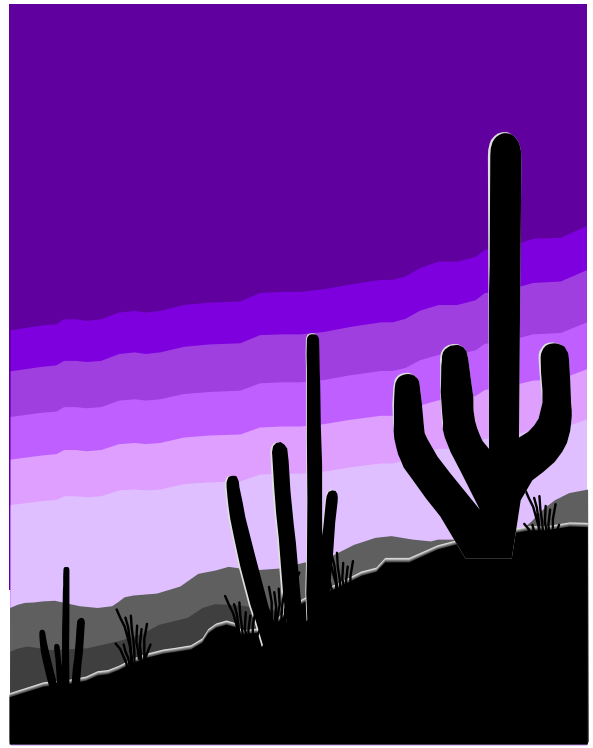
- Additional requirements for Heat Pump Thermostats
  - Capable of preventing supplementary heating when the heating load can be met by the heat pump alone
  - Two-stage thermostats where the back-up heat is controlled by the second stage meets this requirement

HVAC Systems

- Humidity Control
  - Humidistat:



Removing Moisture



Adding Moisture

HVAC Piping Insulation

- HVAC Piping in Unconditioned Space
  - Fluid Temperature >105°F and <55°F

Piping System Types	Fluid Temp Range (EF)	Insulation Thickness in Inches by Pipe Sizes[b]			
		Runouts 2 in.[c]	1 in. and Less	1.25 in. to 2 in.	2.5 in. to 4 in.
Heating Systems					
Low Pressure/Temperature	**201-250**	**1.0**	**1.5**	**1.5**	**2.0**
Low Temperature	**120-200**	**0.5**	**1.0**	**1.0**	**1.5**
Steam Condensate (for feed water)	**Any**	**1.0**	**1.0**	**1.5**	**2.0**
Cooling Systems					
Chilled Water, Refrigerant, or Brine	**40-55** **Below 40**	**0.5** **1.0**	**0.5** **1.0**	**0.75** **1.5**	**1.0** **1.5**

HVAC Piping Insulation

Air Leakage

Vapor Retarders

Materials and Equipment information

Heating and Cooling Equipment Efficiencies

Duct Insulation

Duct Construction

Temperature Controls

HVAC Piping Insulation

Swimming Pools

Circulating Service Hot Water Systems

Electrical

Water Heating Systems

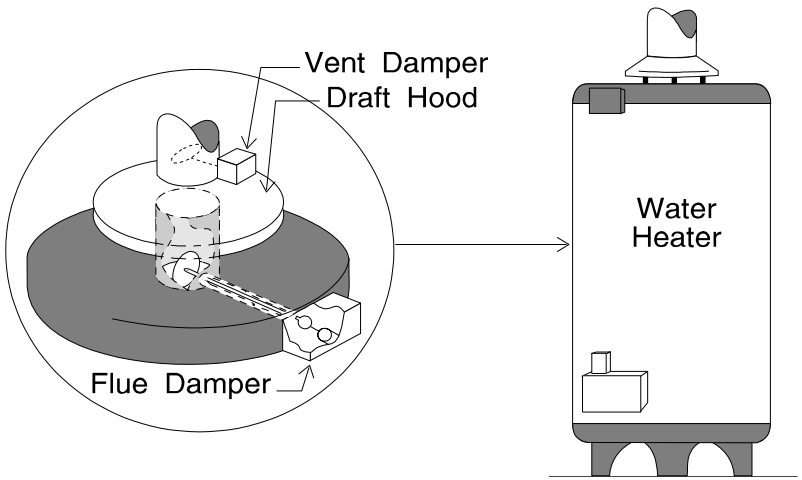
- Swimming pools
  - Heated only
    - On/Off switch on heater
      - pool covers
      - exceptions
  - All
    - Time clocks for circulation pumps

Benefits of a Swimming Pool Cover

- Outdoor pools
  - eliminate evaporative losses from pool
  - cover can save up to 50% on energy consumption
- Indoor pools
  - eliminate evaporative losses
  - reduce or eliminate the need for humidity control

Water Heating Systems

- Water heating efficiency
  - Energy Factor (EF)
  - Meet requirements of Table 504.2
  - Exception



Water Heater Efficiency

TABLE 504.2
MINIMUM PERFORMANCE OF WATER HEATING EQUIPMENT

CATEGORY	TYPE	FUEL	INPUT RATING	V_T[a] (gallons)	INPUT TO V_T RATIO (Btuh/gal)	TEST METHOD	ENERGY FACTOR[b]	THERMAL EFFICIENCY E_t (percent)	STANDBY LOSS (percent/hour)[a]
NAECA-covered water-heating equipment[c]	All	Electric	≤ 12kW	all[e]	—	Note f	≥ 0.93-0.00132V*	—	—
	Storage	Gas	≤ 75,000 Btu/h	all[e]	—	Note f	≥ 0.62-0.0019V*	—	—
	Instantaneous	Gas	≤ 200,000Btu/h[e]	all	—	Note f	≥ 0.62-0.0019V*	—	—
	Storage	Oil	≤ 105,000 Btu/h	all	—	Note f	≥ 0.59-0.0019V*	—	—
	Instantaneous	Oil	≤ 210,000 Btu/h	all	—	Note f	≥ 0.59-0.0019V*	—	—
	Pool heater	Gas/oil	all	all	—	Note g	—	≥ 78%	—
Other water-heating equipment[d]	Storage	Electric	all	all	—	Note h	—	—	≤ 0.30+27/V_T*
	Storage/ instantaneous	Gas/oil	≤ 155,000 Btu/h	all	< 4,000	Note h	—	≥ 78%	≤ 1.3+114/V_T*
			> 155,000 Btu/h	all	< 4,000	Note h	—	≥ 78%	≤ 1.3+95/V_T*
				< 10	≥ 4,000	Note h	—	≥ 80%	—
				≥ 10	≥ 4,000			≥ 77%	≤ 2. 3+67/V_T*
Unfired storage tanks	—	—	—	All	—	—	—	—	≤ 6.5Btuh/ft.^{2}*[i]

For SI: 1 Btu/ft.^{2} = 3.155 W/m^2, 1 Btu/h = 0.2931 W, 1 gallon = 2.785 L, °C. = [(°F.)-32]/1.8.

[a] V_T is the storage volume in gallons as measured during the standby loss test. For the purpose of estimating the standby loss requirement using the rated volume shown on the rating plate V_T should be no less than 0.95V for gas and oil water heaters and no less than 0.90V for electric water heaters.

[b] V is rated storage volume in gallons as specified by the manufacturer.

[c] Consistent with National Appliance Energy Conservation Act (NAECA) of 1987.

[d] All except those water heaters covered by NAECA.

[e] DOE CFR 10; Part 430, Subpart B, Appendix E applies to electric and gas storage water heaters with rated volumes 20 gallons and gas instantaneous water heaters with input ratings of 50,000 to 200,000 Btuh.

[f] DOE CFR 10; Part 430, Subpart B, Appendix E.

[g] ANSI Z21.56.

[h] ANSI Z21.10.3. When testing an electric storage water heater for standby loss using the test procedure of Section 2.9 of ANSI Z21.10.3, the electrical supply voltage shall be maintained within ± 1 percent of the center of the voltage range specified on the water heater nameplate. Also, when needed for calculations, the thermal efficiency (E_t) shall be 98 percent. When testing an oil water heater using the test procedures of Sections 2.8 and 2.9 of ANSI Z21.10.3, the following modifications will be made: A vertical length of the flue pipe shall be connected to the flue gas outlet of sufficient height to establish the minimum draft specified in the manufacturer's installation instructions. All measurements of oil consumption will be taken by instruments with an accuracy of ± 1 percent or better. The burner shall be adjusted to achieve an hourly Btu input rate within ± 2 percent of the manufacturer's specified input rate with the CO_2 reading as specified by the manufacturer with smoke no greater than 1 and the fuel pump pressure within ± 1percent of the manufacturer's specification.

[i] Heat loss of tank surface area (Btu/h · ft^2) based on 80°F. water-air temperature difference.

* Minimum efficiencies marked with an asterisk are established by preemptive federal law and are printed for the convenience of the user.

Water Heating Systems

- Circulating hot water piping
  - Pump operation
  - Pipe insulation
    - Exception - where piping heat loss without insulation does not increase annual energy requirements of building

Circulation System Piping

- Insulation is essential in reducing the waste of energy in distribution
- One-inch of insulation on DHW pipes could result in a 50% reduction in the distribution heat loss

Conservation of Hot Water

- Showers
  - Showerheads max. flow rate of 2.5 gpm at a pressure of 80 psi

Air Leakage

Vapor Retarders

Materials and Equipment information

Heating and Cooling Equipment Efficiencies

Duct Insulation

Duct Construction

Temperature Controls

HVAC Piping Insulation

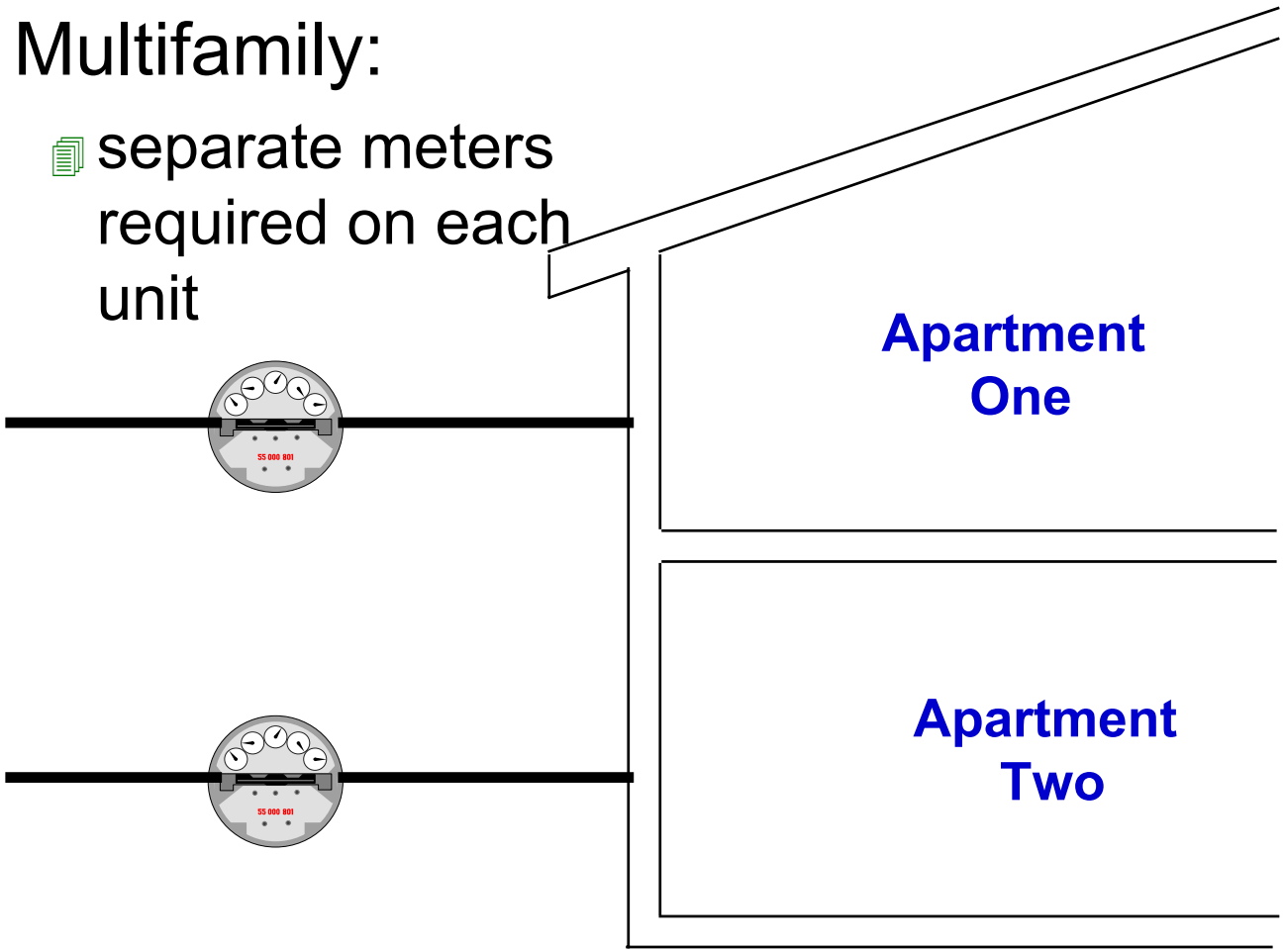
Swimming Pools

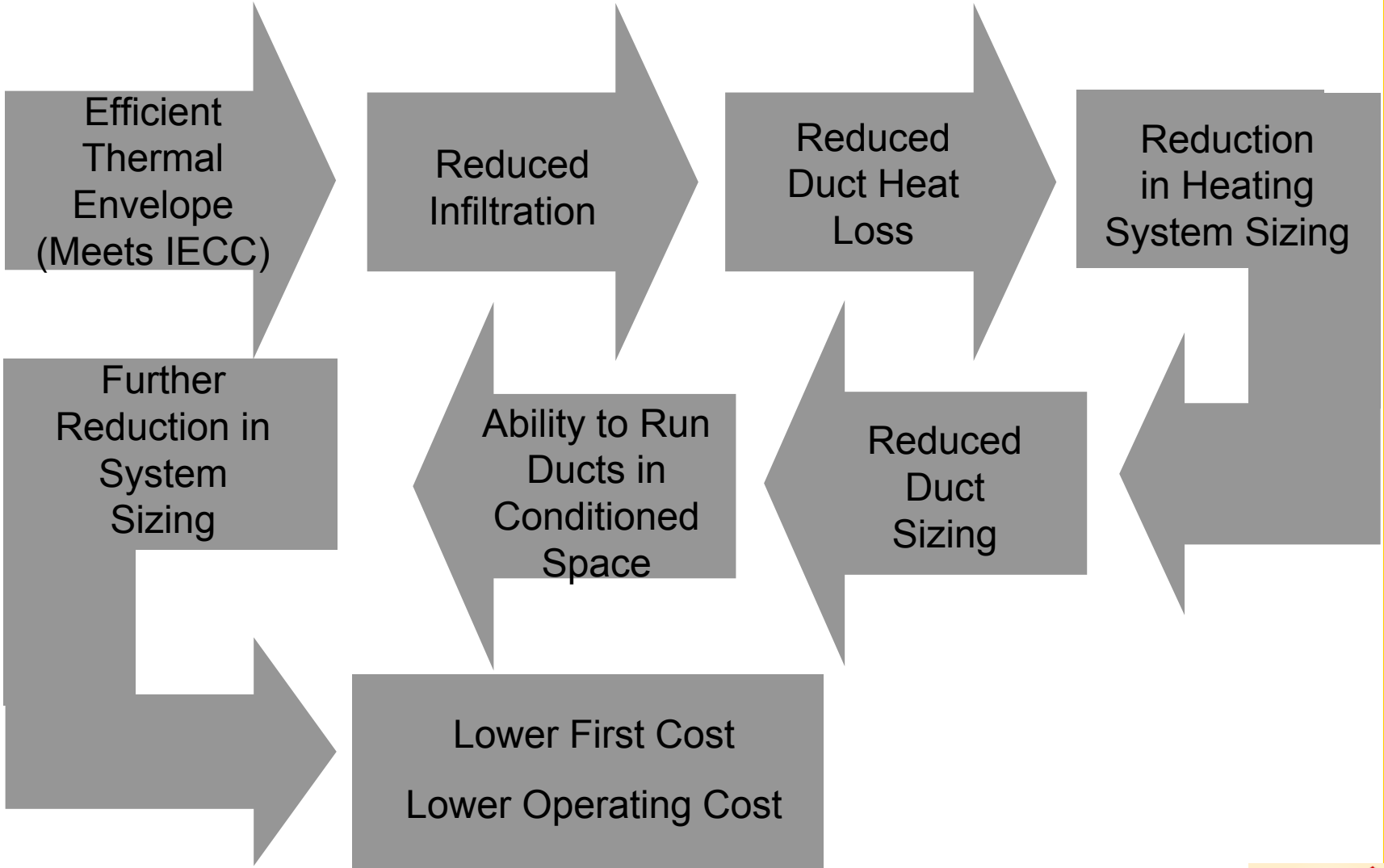
Circulating Service Hot Water Systems

Electrical

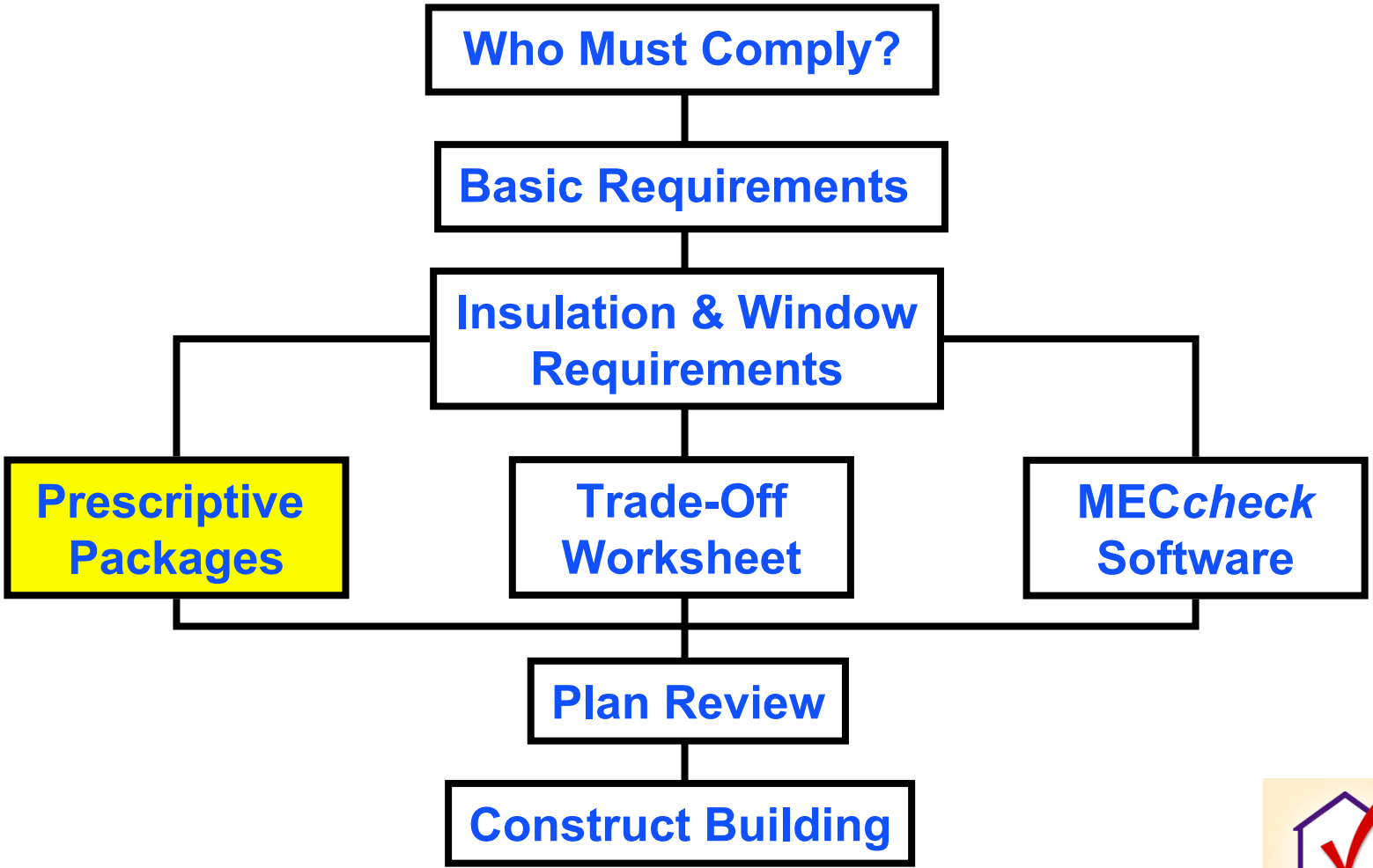
Electrical Systems

- Electrical metering
  - Multifamily:
    - separate meters required on each unit




Efficient Thermal Envelope (Meets IECC)
Reduced Infiltration
Reduced Duct Heat Loss
Reduction in Heating System Sizing
Further Reduction in System Sizing
Ability to Run Ducts in Conditioned Space
Reduced Duct Sizing
Lower First Cost
Lower Operating Cost

Compliance Path



Prescriptive Package Approach

Overview

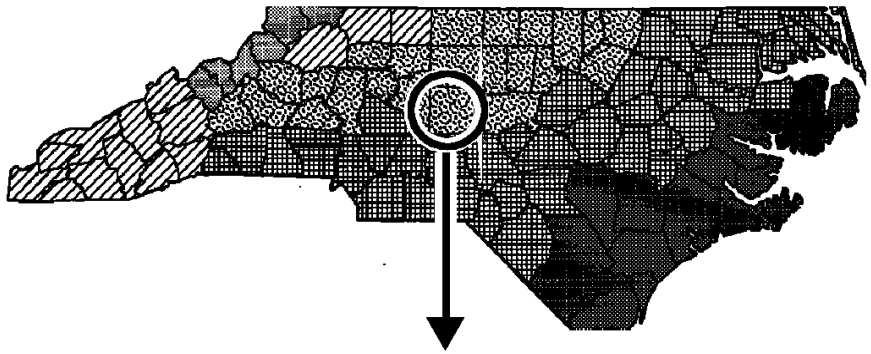
- Straight forward pre-calculated compliance approach
- Climate zone dependent
- R & U-Value requirements specified

Prescriptive Packages - Zone 6

1995 Model Energy Code for Single-Family Buildings

Package	MAXIMUM		MINIMUM						Heating/Cooling Equipment Efficiency[9]
	Glazing Area Percent[1]	Glazing U-Value[2]	Ceiling R-Value[3]	Wall R-Value[4]	Floor R-Value[5]	Basement Wall R-Value[6]	Slab Perimeter R-Value[7]	Crawl Space Wall R-Value[8]	
1	12%	0.70	R-30	R-11	R-19	R-6	R-5	R-7	Normal
2	12%	0.60	R-38	R-13	R-11	R-4	R-0	R-4	Normal
3	15%	0.60	R-30	R-13	R-19	R-6	R-4	R-7	Normal
4	15%	0.45	R-38	R-11	R-11	R-4	R-0	R-4	Normal
5	18%	0.60	R-38	R-19	R-15	R-5	R-2	R-6	Normal
6	18%	0.45	R-30	R-13	R-13	R-5	R-2	R-5	Normal
7	22%	0.45	R-38	R-13	R-19	R-6	R-4	R-7	Normal
8	12%	0.90	R-26	R-13	R-11	R-4	R-0	R-4	High Heating
9	15%	0.75	R-30	R-13	R-11	R-4	R-0	R-4	High Heating
10	18%	0.70	R-30	R-13	R-15	R-5	R-2	R-6	High Heating
11	22%	0.60	R-30	R-11	R-19	R-6	R-2	R-7	High Heating
12	12%	0.70	R-26	R-11	R-15	R-5	R-2	R-6	High Cooling

Prescriptive Package Approach



1. Find your climate zone.

Prescriptive Packages - Zone 8
1995 Model Energy Code for Single-Family Buildings

Package	Glazing Area Percent	Glazing U-Value	Ceiling R-Value	Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab Perimeter R-Value	Crawl Space Wall U-Value	Heating/Cooling Equipment Efficiency
1	12%	0.60	R-30	R-13	R-19	R-8	R-4	R-10	Normal
2	12%	0.45	R-30	R-13	R-11	R-5	R-2	R-6	Normal
3	15%	0.65	R-38	R-18	R-19	R-8	R-6	R-11	Normal
4	15%	0.50	R-30	R-13	R-19	R-8	R-5	R-10	Normal
5	15%	0.40	R-38	R-13	R-11	R-5	R-2	R-6	Normal
6	18%	0.55	R-38	R-18	R-19	R-8	R-6	R-11	Normal

2. Select a Prescriptive Package.

MECcheck

Prescriptive Package Worksheet

Builder Name _____ Date _____
Builder Address _____
Building Address _____
Zone Number _____ Package Number _____
Submitted By _____ Phone Number _____

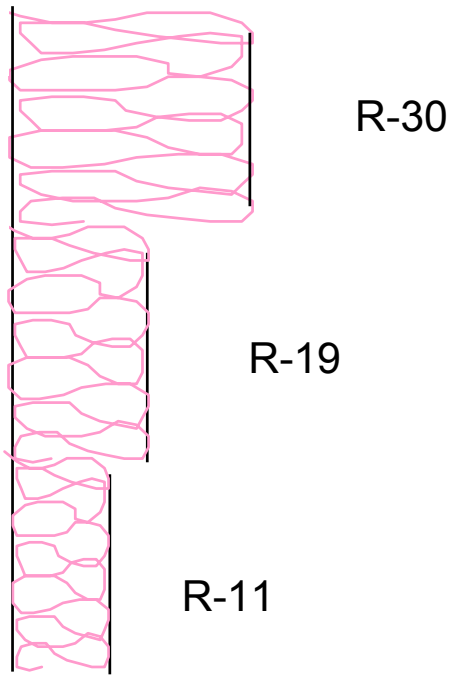
Enforcement Agency
Permit #
Checked By
Date

PROPOSED	REQUIRED
Glazing Area	
100 X _____ (Glazing Area) + _____ (Gross Wall Area) = _____ % (Proposed Glazing Area)	_____ % (Maximum Glazing Area)

3. Complete the *Prescriptive Package Worksheet.*

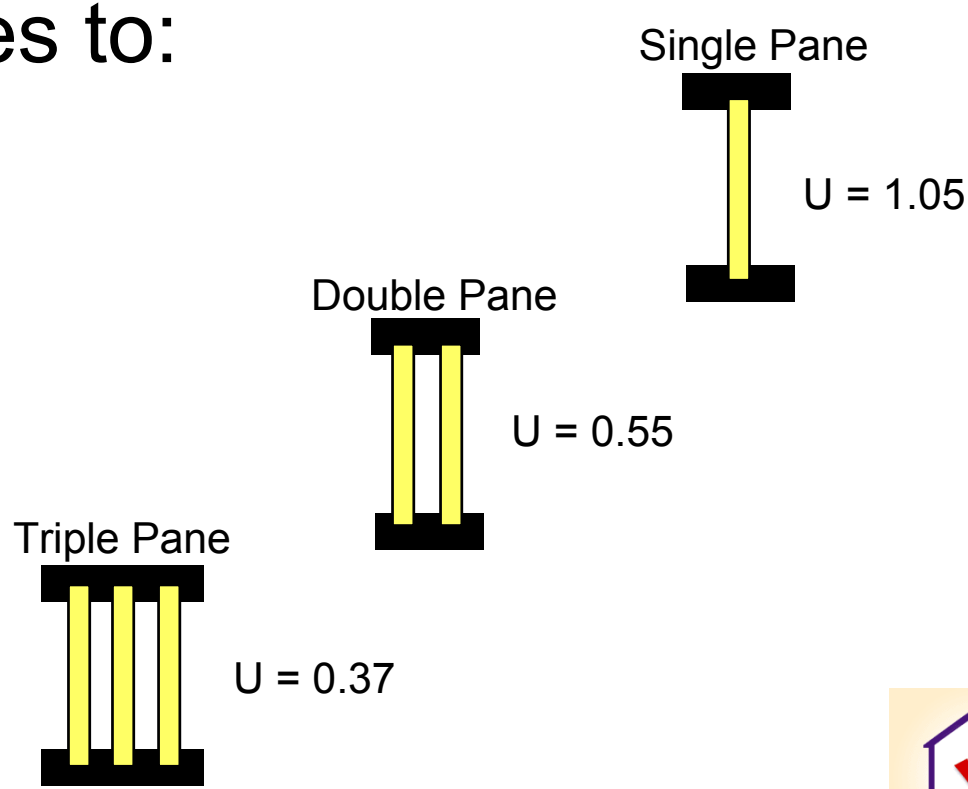
R-Values

- Higher R-value = Better Insulated
- R-value applies to:
  - All walls
  - Raised floors
  - Roofs

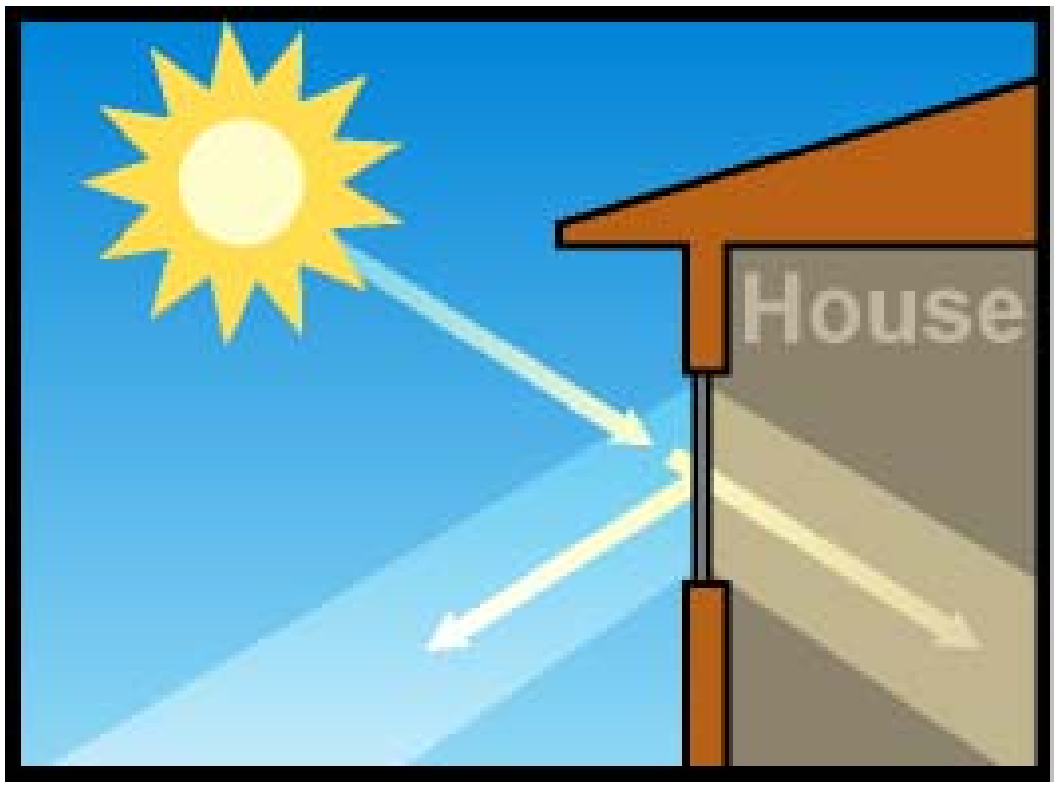


U-Values

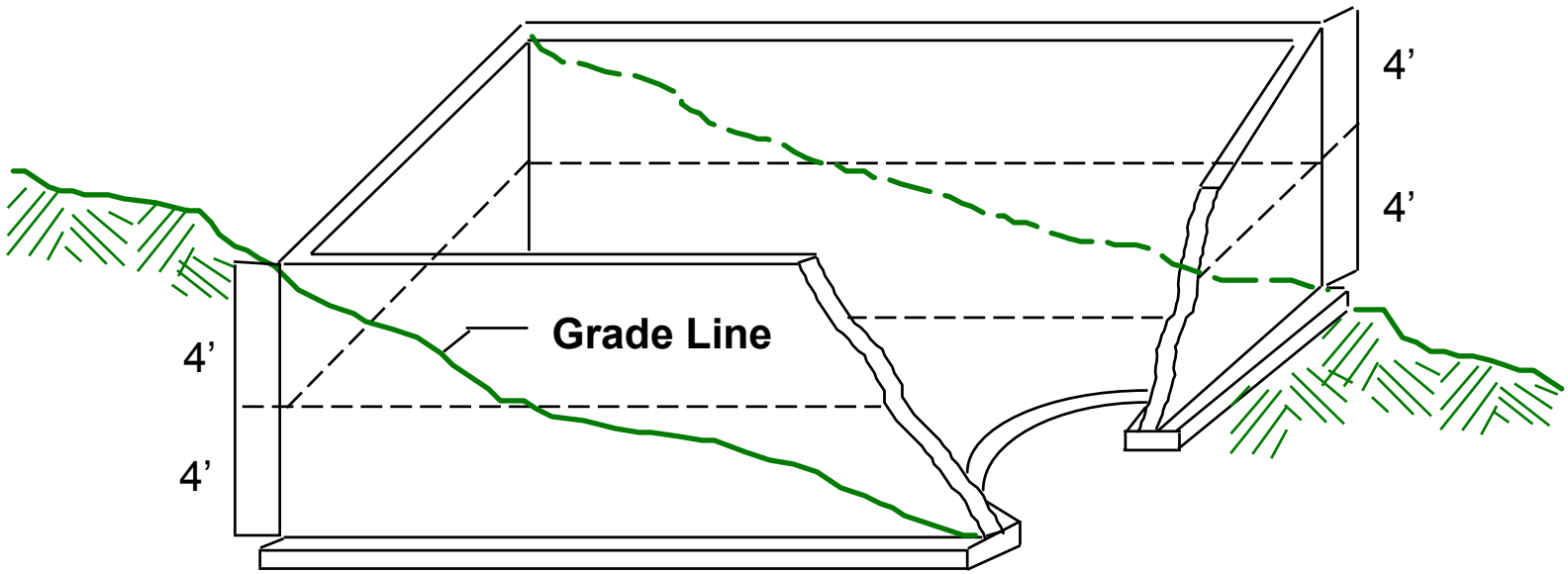
- Lower U-value = Better Insulated
- U-value applies to:
  - Windows
  - Skylights
  - Doors



SHGC

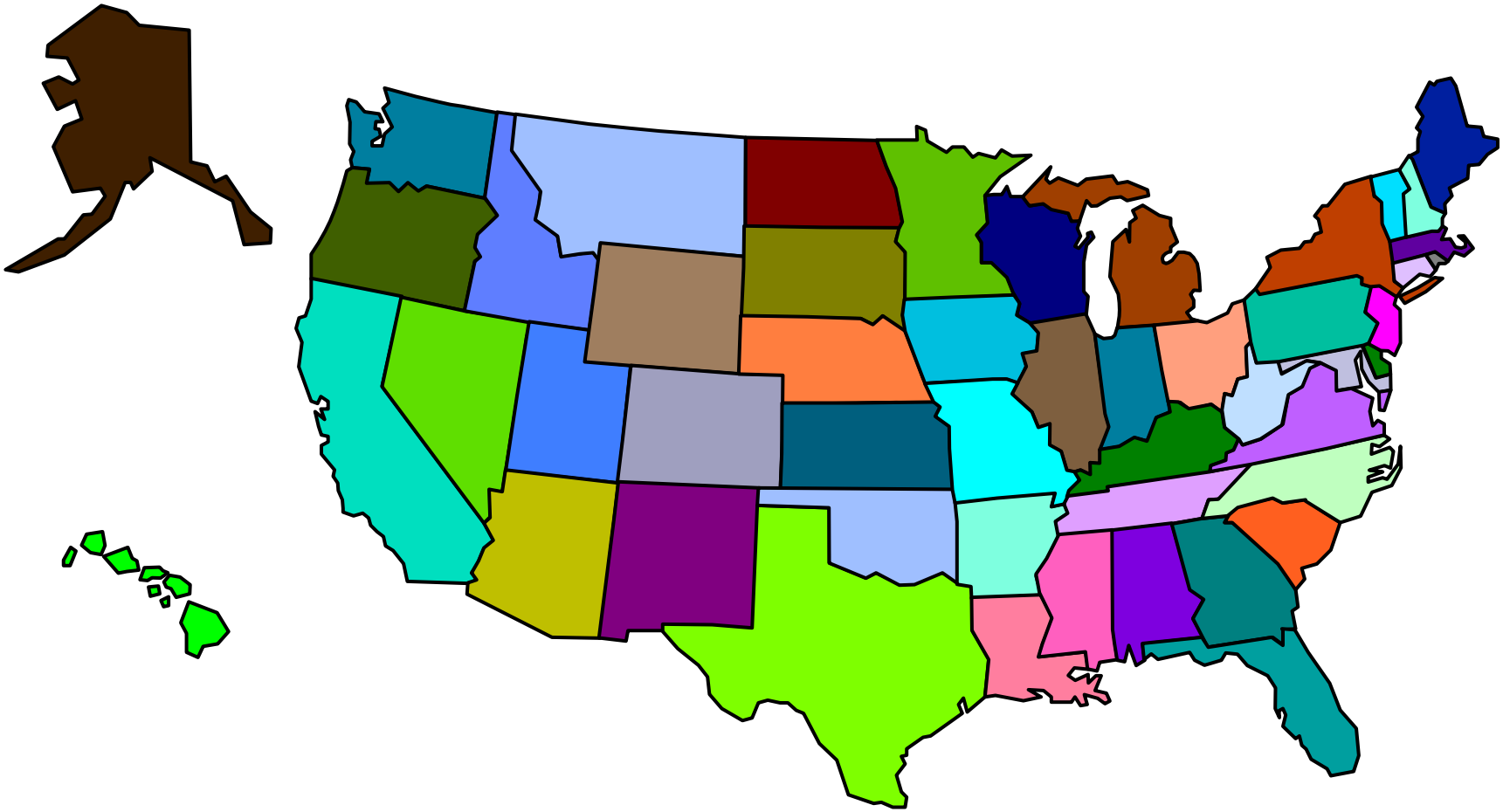


Basement Walls

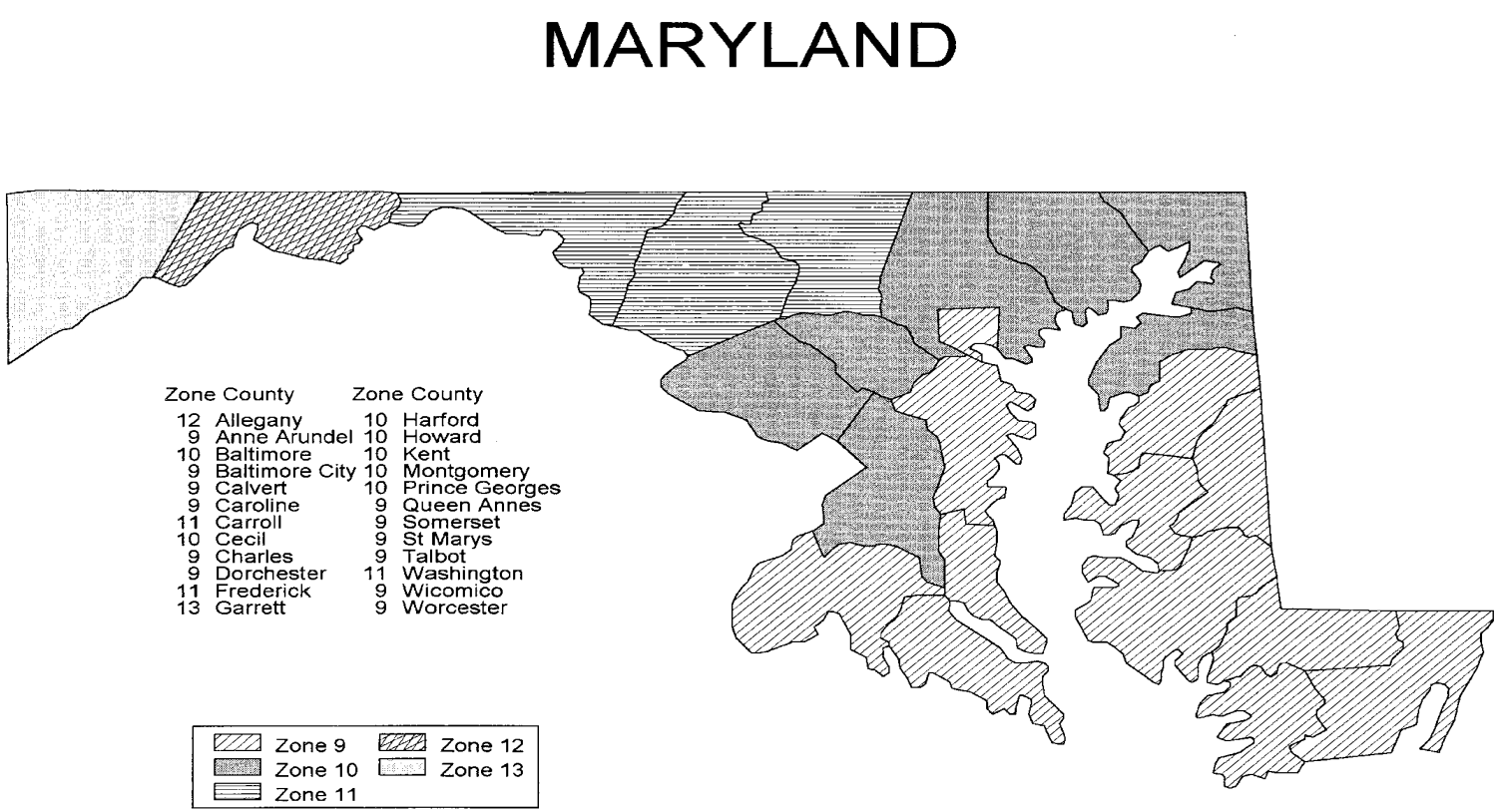


- Above Grade per Basement Wall Definition

Prescriptive Packages - Find The State



Prescriptive Packages - Find The County



Prescriptive Packages - Find The Zone

1995 Single-Family Prescriptive Packages -

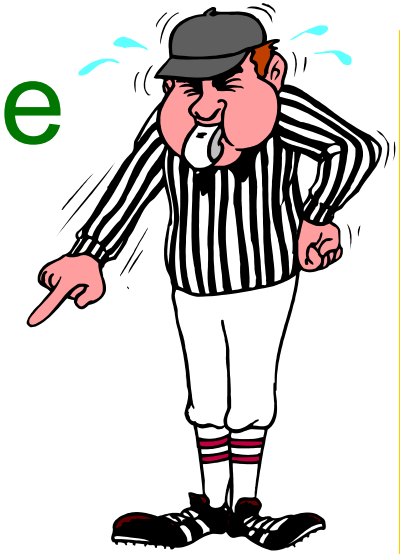
Package	MAXIMUM		MINIMUM						Heating/Cooling Equipment Efficiency[9]
	Glazing Area %[1]	Glazing U-Value[2]	Ceiling R-Value[3]	Wall R-Value[4]	Floor R-Value[5]	Basement Wall R-Value[6]	Slab Perimeter R-Value[7]	Crawl Space Wall R-Value[8]	
1	12%	0.65	R-38	R-19	R-19	R-9	R-7	R-17	Normal
2	12%	0.45	R-30	R-13	R-19	R-9	R-6	R-17	Normal
3	15%	0.55	R-38	R-19	R-21	R-10	--	R-22	Normal
4	15%	0.40	R-38	R-13	R-19	R-9	R-5	R-16	Normal
5	18%	0.45	R-38	R-19	R-19	R-9	R-7	R-17	Normal
6	18%	0.35	R-38	R-13	R-19	R-9	R-6	R-17	Normal
7	22%	0.40	R-49	R-21	R-19	R-9	R-6	R-17	Normal
8	12%	0.75	R-38	R-11	R-19	R-8	R-2	R-17	High Heating
9	12%	0.65	R-38	R-13	R-11	R-6	R-0	R-8	High Heating
10	15%	0.65	R-30	R-13	R-19	R-9	R-2	R-22	High Heating
11	15%	0.50	R-30	R-13	R-11	R-6	R-0	R-8	High Heating
12	18%	0.55	R-30	R-13	R-19	R-9	R-2	R-22	High Heating
13	18%	0.45	R-38	R-13	R-11	R-5	R-0	R-8	High Heating
14	22%	0.55	R-38	R-17	R-19	R-9	R-2	R-22	High Heating
15	22%	0.40	R-30	R-13	R-13	R-6	R-2	R-10	High Heating
16	12%	0.75	R-30	R-13	R-15	R-7	R-2	R-14	High Heat/Cool
17	12%	0.65	R-26	R-13	R-13	R-6	R-0	R-10	High Heat/Cool
18	15%	0.70	R-30	R-15	R-19	R-9	R-2	R-22	High Heat/Cool
19	15%	0.55	R-26	R-13	R-13	R-6	R-2	R-10	High Heat/Cool
20	18%	0.65	R-38	R-19	R-15	R-7	R-2	R-14	High Heat/Cool
21	18%	0.50	R-38	R-13	R-13	R-6	R-0	R-10	High Heat/Cool
22	22%	0.60	R-38	R-17	R-26	R-11	R-8	--	High Heat/Cool
23	22%	0.45	R-38	R-13	R-15	R-7	R-2	R-12	High Heat/Cool

Prescriptive Packages - Find The Package

1995 Single-Family Prescriptive Packages - Zone 10

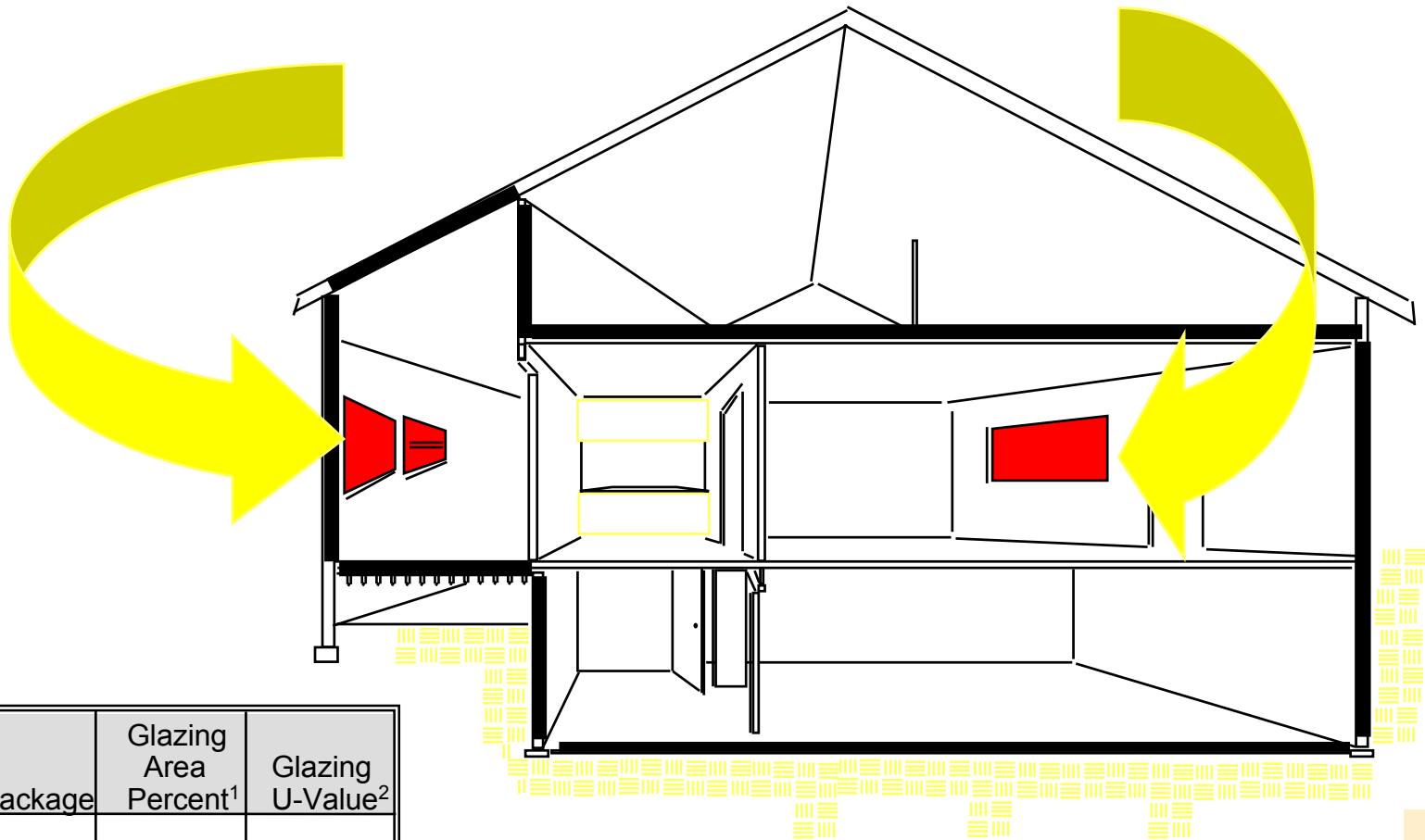
Package	MAXIMUM		MINIMUM						Heating/Cooling Equipment Efficiency[9]
	Glazing Area %[1]	Glazing U-Value[2]	Ceiling R-Value[3]	Wall R-Value[4]	Floor R-Value[5]	Basement Wall R-Value[6]	Slab Perimeter R-Value[7]	Crawl Space Wall R-Value[8]	
1	12%	0.65	R-38	R-19	R-19	R-9	R-7	R-17	Normal
2	12%	0.45	R-30	R-13	R-19	R-9	R-6	R-17	Normal
4	15%	0.40	R-38	R-13	R-19	R-9	R-5	R-16	Normal
5	18%	0.45	R-38	R-19	R-19	R-9	R-7	R-17	Normal
6	18%	0.35	R-38	R-13	R-19	R-9	R-6	R-17	Normal
7	22%	0.40	R-49	R-21	R-19	R-9	R-6	R-17	Normal
8	12%	0.75	R-38	R-11	R-19	R-8	R-2	R-17	High Heating
9	12%	0.65	R-38	R-13	R-11	R-6	R-0	R-8	High Heating
10	15%	0.65	R-30	R-13	R-19	R-9	R-2	R-22	High Heating
11	15%	0.50	R-30	R-13	R-11	R-6	R-0	R-8	High Heating
12	18%	0.55	R-30	R-13	R-19	R-9	R-2	R-22	High Heating
13	18%	0.45	R-38	R-13	R-11	R-5	R-0	R-8	High Heating
14	22%	0.55	R-38	R-17	R-19	R-9	R-2	R-22	High Heating
15	22%	0.40	R-30	R-13	R-13	R-6	R-2	R-10	High Heating
16	12%	0.75	R-30	R-13	R-15	R-7	R-2	R-14	High Heat/Cool
17	12%	0.65	R-26	R-13	R-13	R-6	R-0	R-10	High Heat/Cool
18	15%	0.70	R-30	R-15	R-19	R-9	R-2	R-22	High Heat/Cool
19	15%	0.55	R-26	R-13	R-13	R-6	R-2	R-10	High Heat/Cool
20	18%	0.65	R-38	R-19	R-15	R-7	R-2	R-14	High Heat/Cool
21	18%	0.50	R-38	R-13	R-13	R-6	R-0	R-10	High Heat/Cool
22	22%	0.60	R-38	R-17	R-26	R-11	R-8	--	High Heat/Cool
23	22%	0.45	R-38	R-13	R-15	R-7	R-2	R-12	High Heat/Cool

Rules of the Game



- Insulation R-values - count for insulation only
- Door U-values < 0.35
  - Exception - one door
- Window U-value - exclude 1% “allowed area” from requirement
- Climate Zones 1-7 shall have an area-weighted average SHGC of < 0.4
- Basement windows count in “window area”/basement walls don’t count in exterior wall area
- Ceiling insulation R-value - R-30 for R-38/R-38 for R-49 for raised or oversize truss construction
- Floors over “outside air” must meet ceiling insulation requirements
- Heating Efficiency - “High” = 90% AFUE, 7.8 HSPF
- Cooling Efficiency - “High” = 12.0 SEER

Prescriptive Packages - Glazing Area and U-Value



Package	Glazing Area Percent[1]	Glazing U-Value[2]
3	15%	0.55

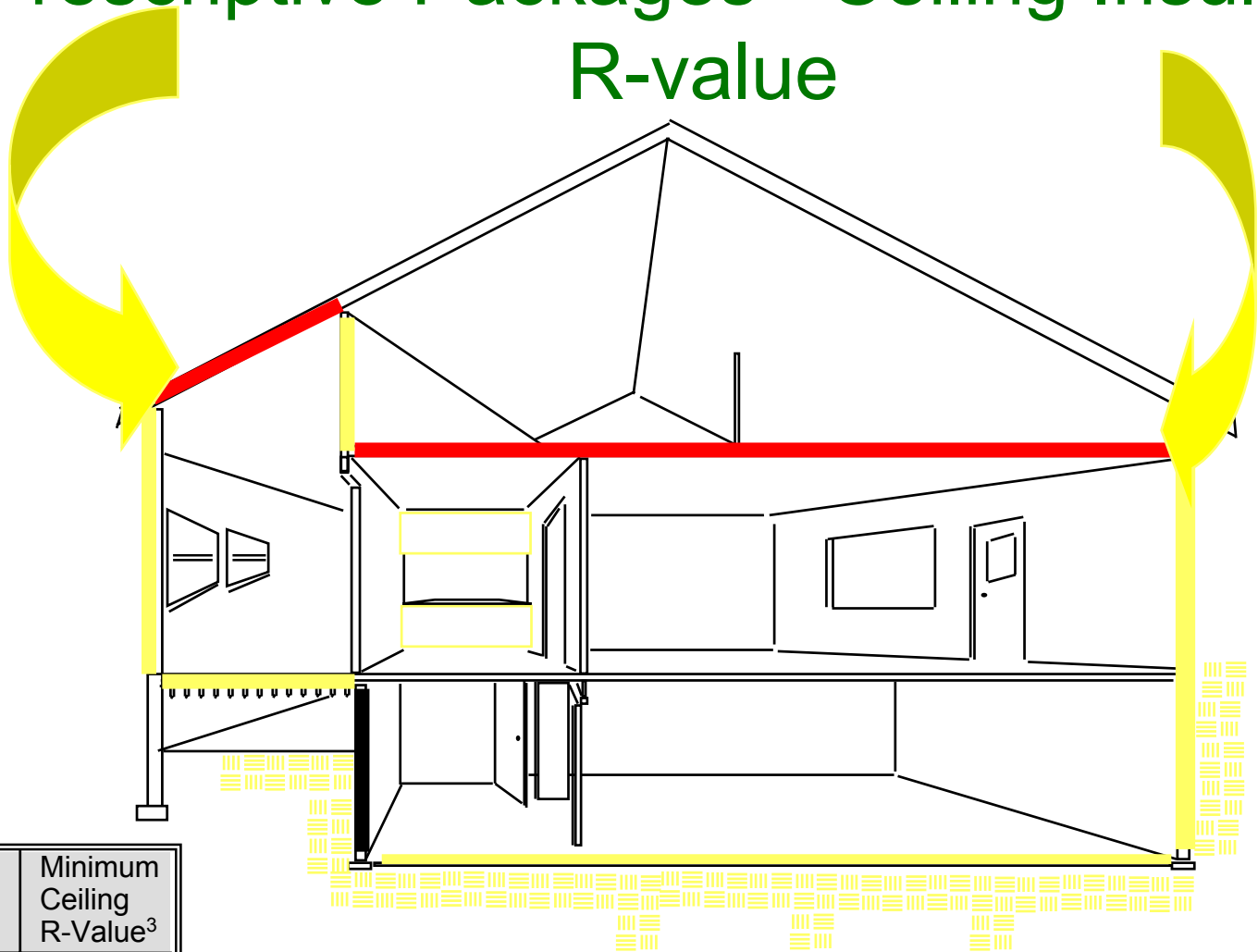
Glazing Default U-Values

	Single Glazed	Double Glazed
METAL WITHOUT THERMAL BREAKS		
Operable	1.30	0.87
Fixed	1.17	0.69
Door	1.26	0.80
Skylight	1.92	1.30
METAL WITH THERMAL BREAKS		
Operable	1.07	0.67
Fixed	1.11	0.63
Door	1.10	0.66
Skylight	1.50	0.88
WOOD/VINYL		
Operable	0.94	0.56
Fixed	1.04	0.57
Door	0.98	0.56
Skylight	1.47	0.85

For SI: 1 inch = 25.4 mm.

Glass block assemblies shall have a U-value of 0.60.

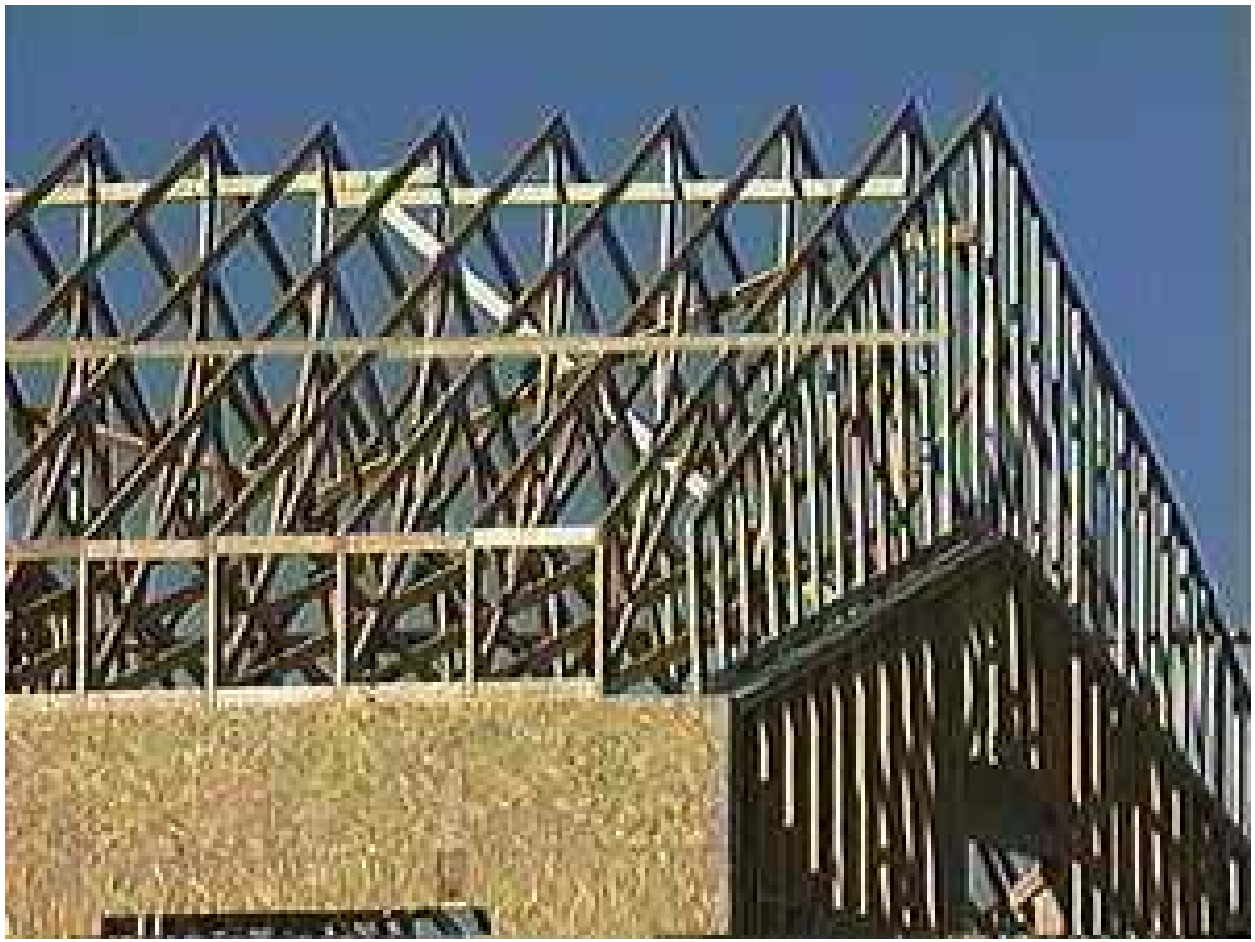
Prescriptive Packages - Ceiling Insulation R-value



Package	Minimum Ceiling R-Value[3]
3	R-38

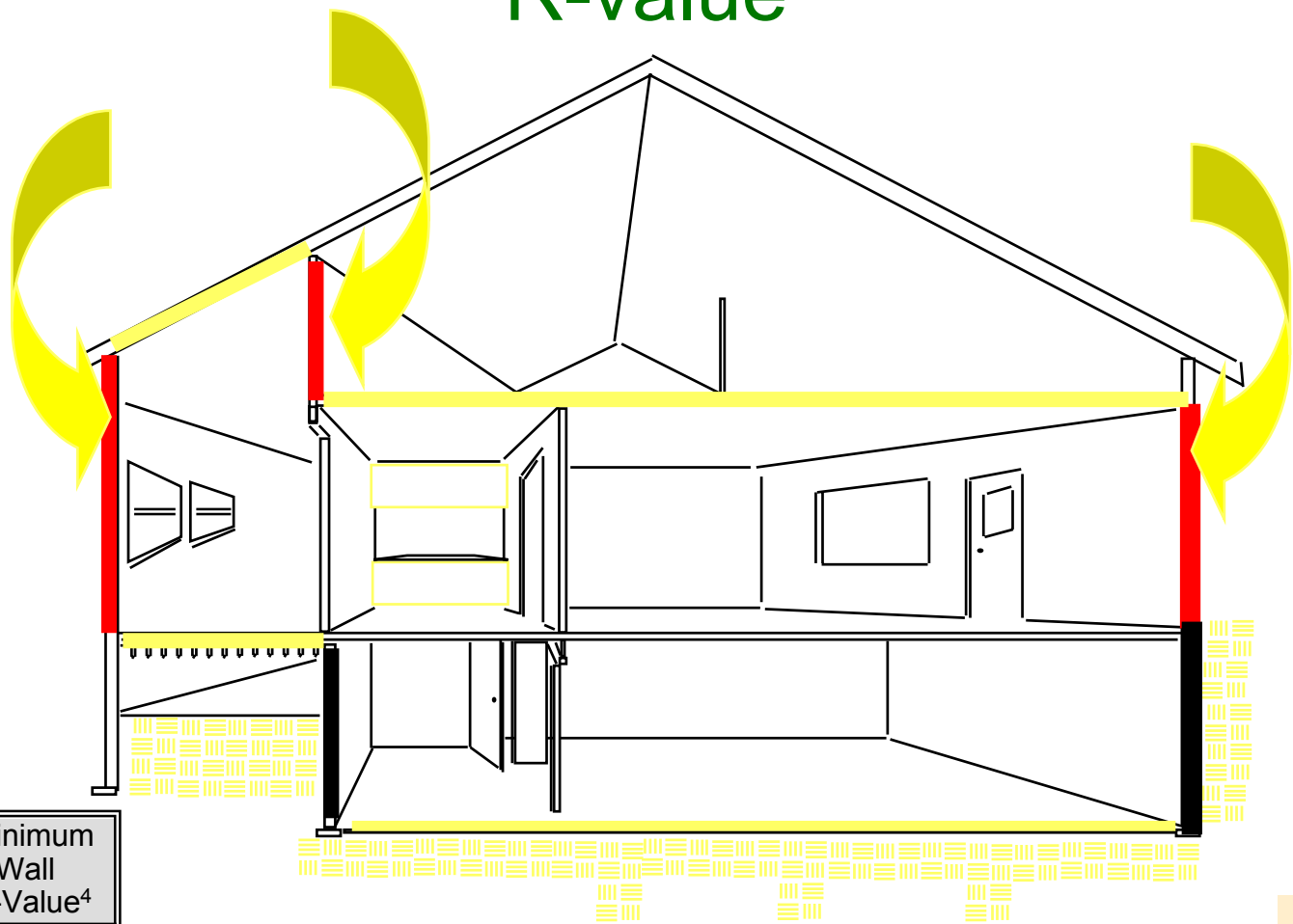
Advanced Framing

Raised Heel Trusses



Advanced Framing

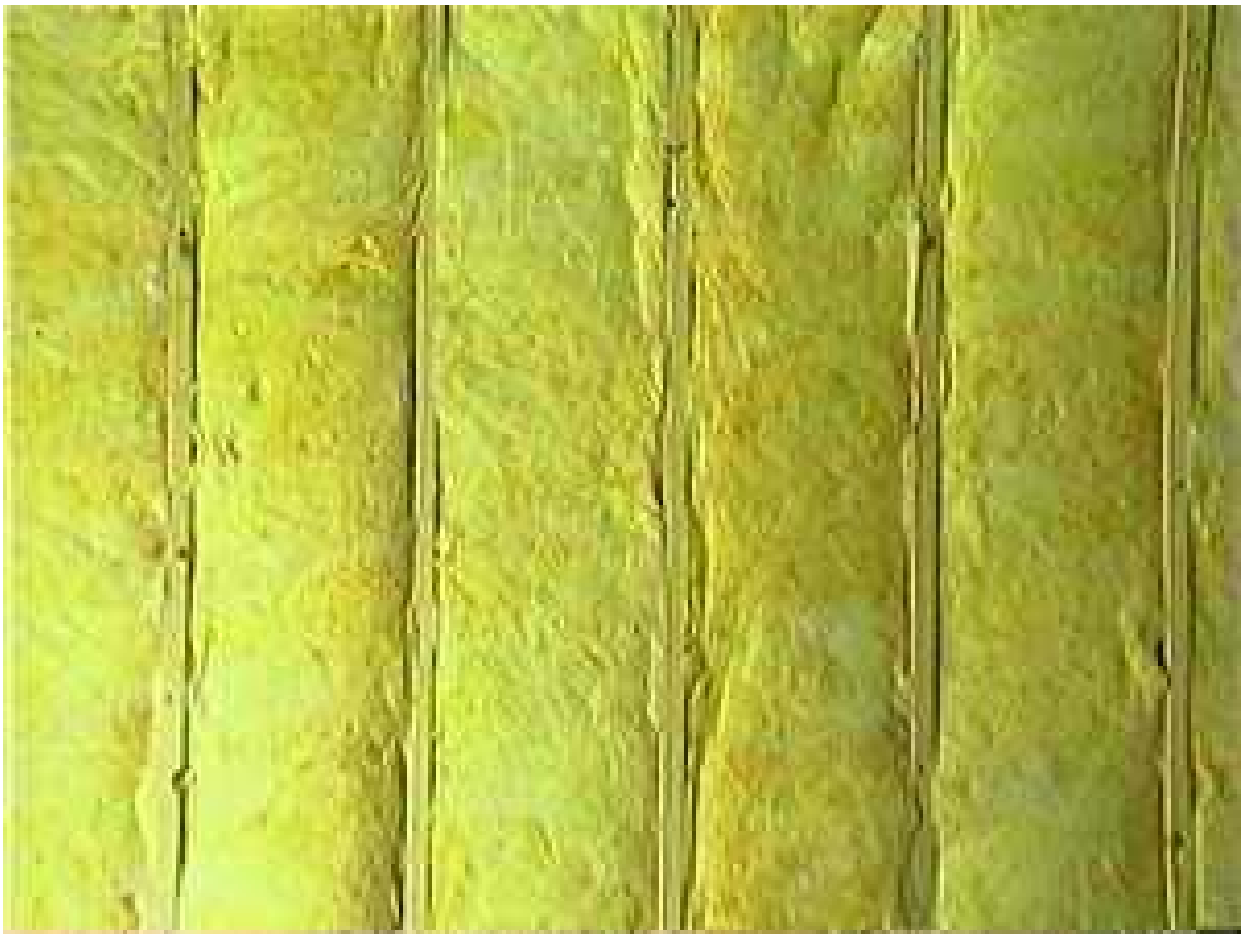
Prescriptive Packages - Wall Insulation R-value



Package	Minimum Wall R-Value[4]
3	R-19

Wall Insulation

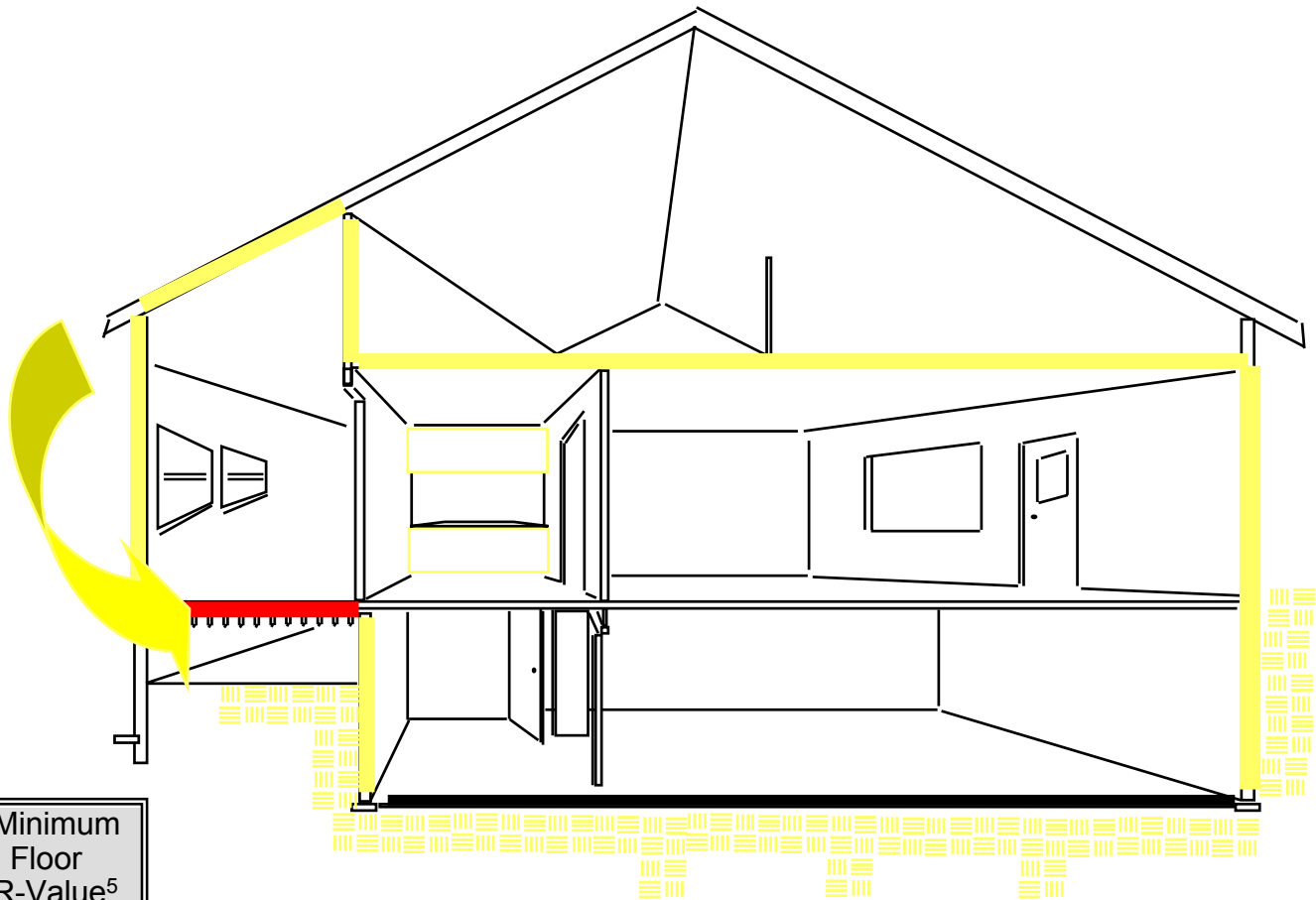
Wall Insulation



Wall Insulation

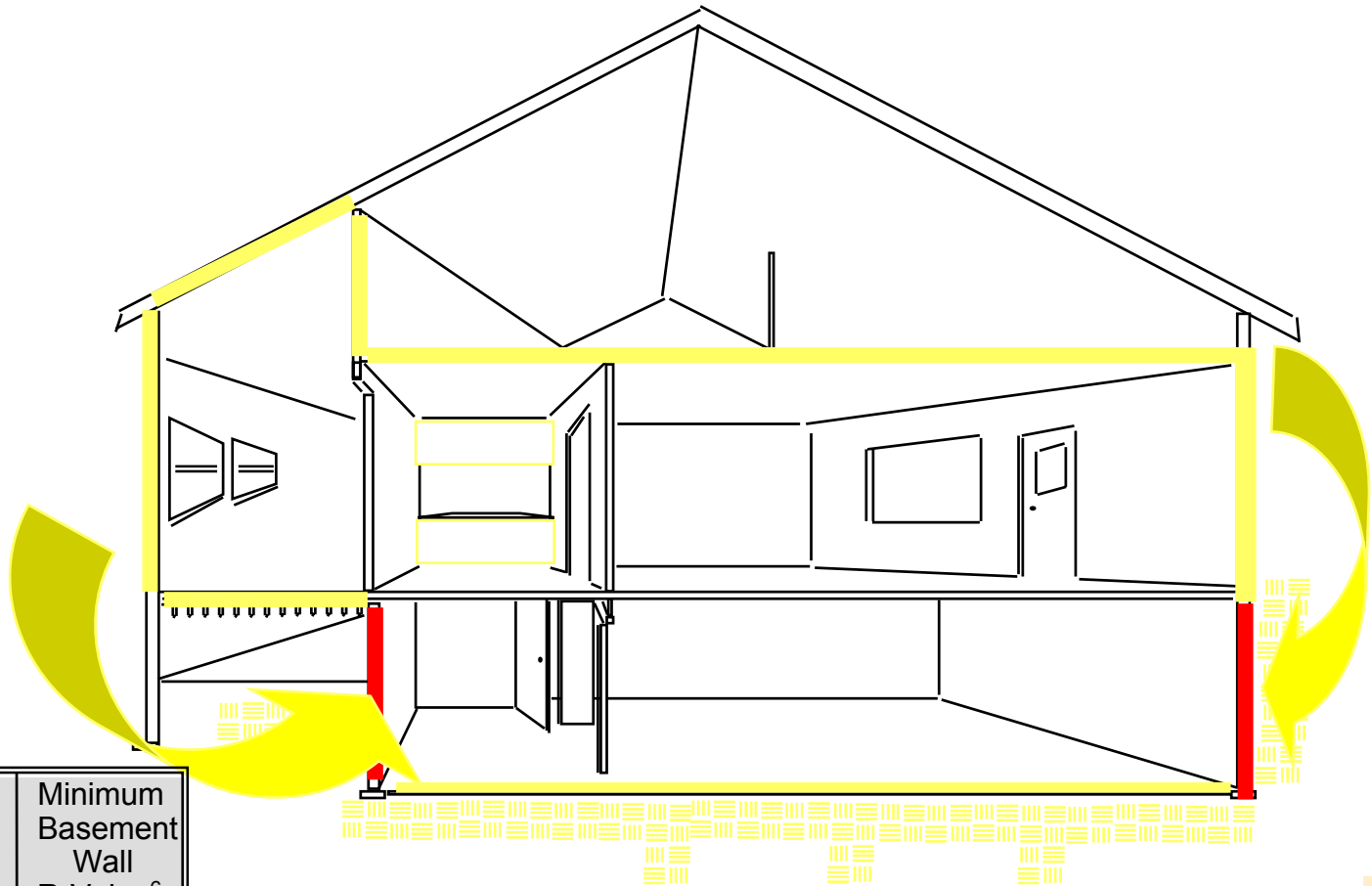
Wall Insulation - BAD

Prescriptive Packages – Floor R-value



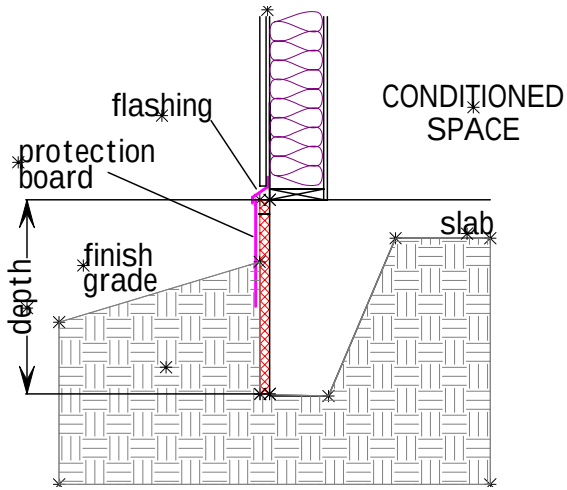
Package	Minimum Floor R-Value[5]
3	R-21

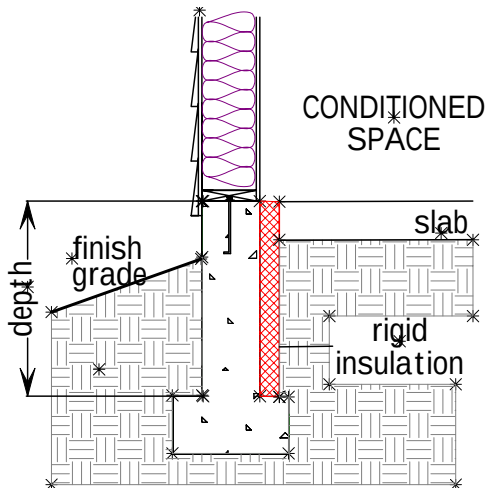
Prescriptive Packages - Basement Wall R-value

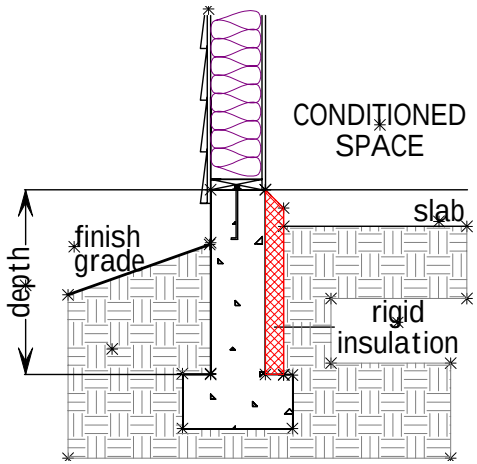


Package	Minimum Basement Wall R-Value[6]
3	R-10

Prescriptive Packages - Slab Perimeter R-value





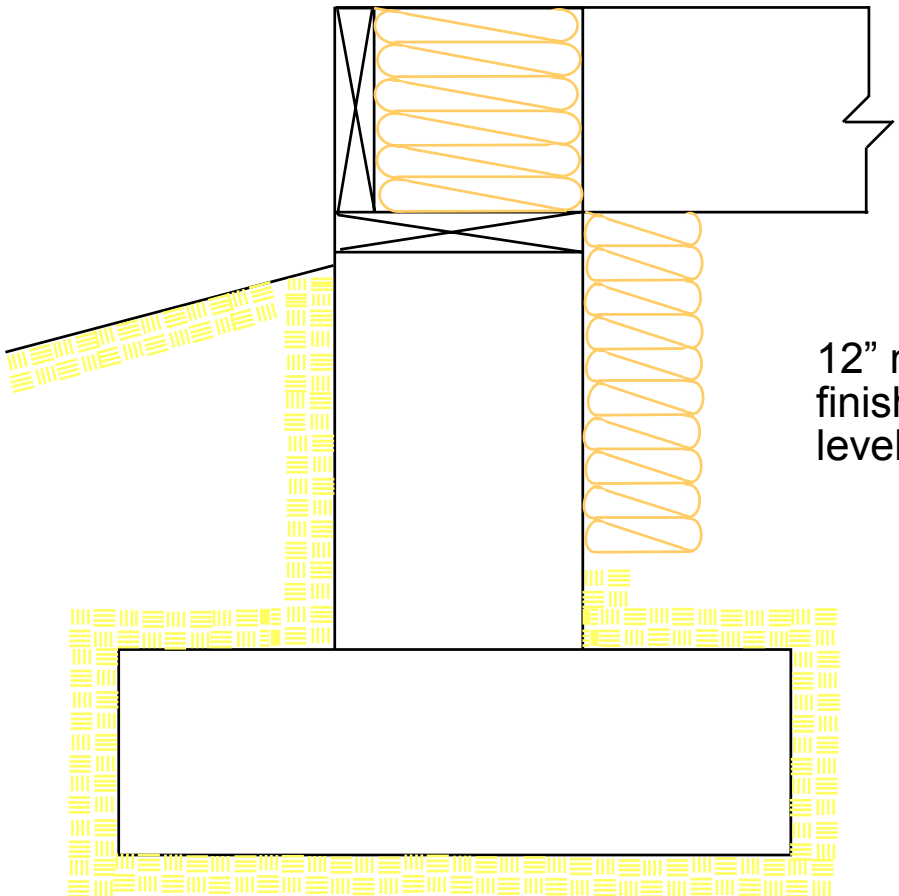


Package	Minimum Slab Perimeter R-Value[7]
3	-

<u>Insulation Depth</u>
-Not required in Zone 1
-24” Zone 2 to Zone 12
-48” Zone 13 to Zone 17

Slab Edge Insulation

Prescriptive Packages - Crawl Space Wall R-value



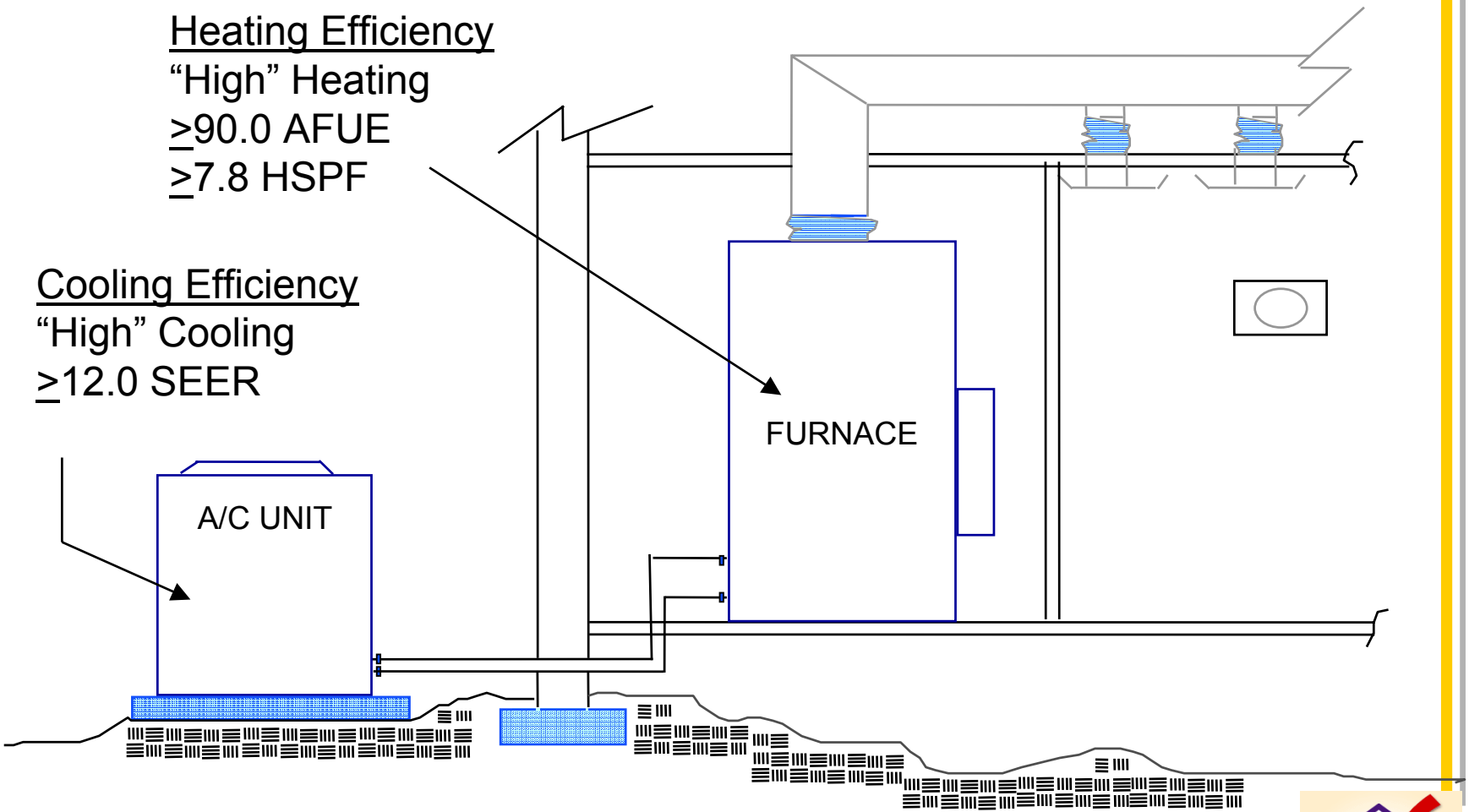
12” minimum below finished exterior grade level

Package	Minimum Crawl Space Wall R-Value[8]
3	R-22

Prescriptive Packages - HVAC Systems

Heating Efficiency
"High" Heating
≥90.0 AFUE
≥7.8 HSPF

Cooling Efficiency
"High" Cooling
≥12.0 SEER

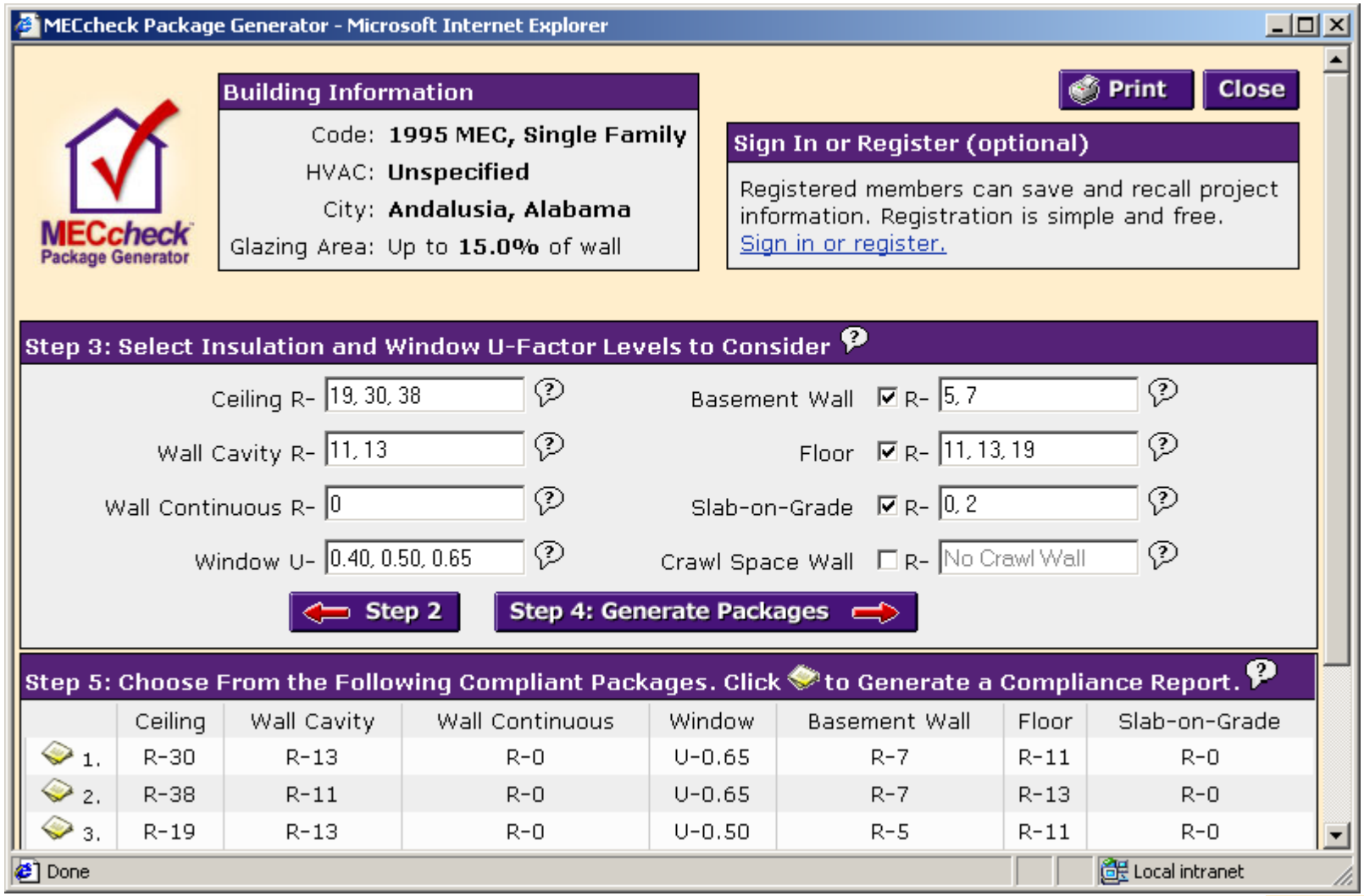


Prescriptive Packages - Compare the Packages

Package	Glazing U-Value[2]	Ceiling R-Value[3]	Wall R-Value[4]	Floor R-Value[5]	Basement Wall R-Value[6]	Slab Perimeter R-Value[7]	Crawl Space Wall R-Value[8]	Heating/Cooling Equipment Efficiency[9]
3 17	0.55 0.65	R-38 R-26	R-19 R-13	R-21 R-13	R-10 R-6	- R-0	R-22 R-10	Normal High Heat/Cool

MEC*check* Package Generator

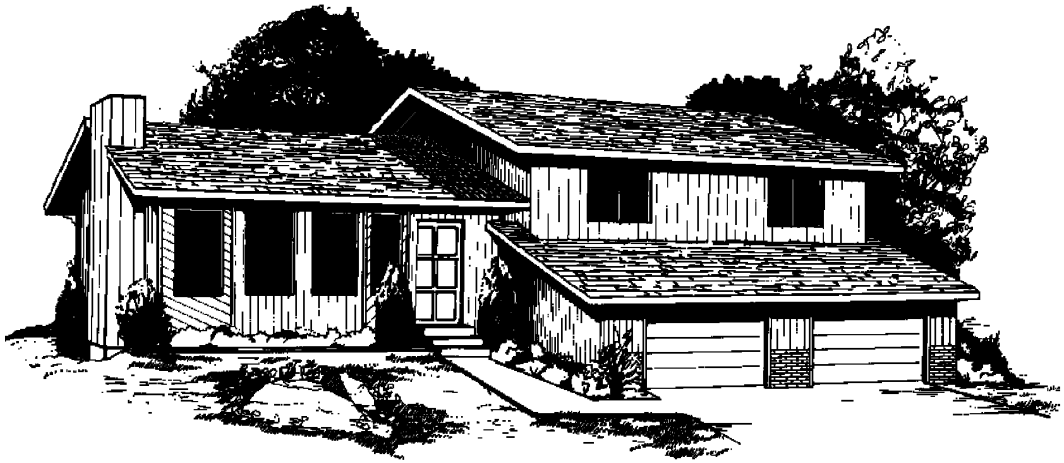
- Allows you to generate your own code-compliant insulation and window packages based on building location, window-to-wall ratio, and YOUR choice of insulation levels
- Select a package you desire and print or save (in PDF) a Compliance Report and Inspection Checklist

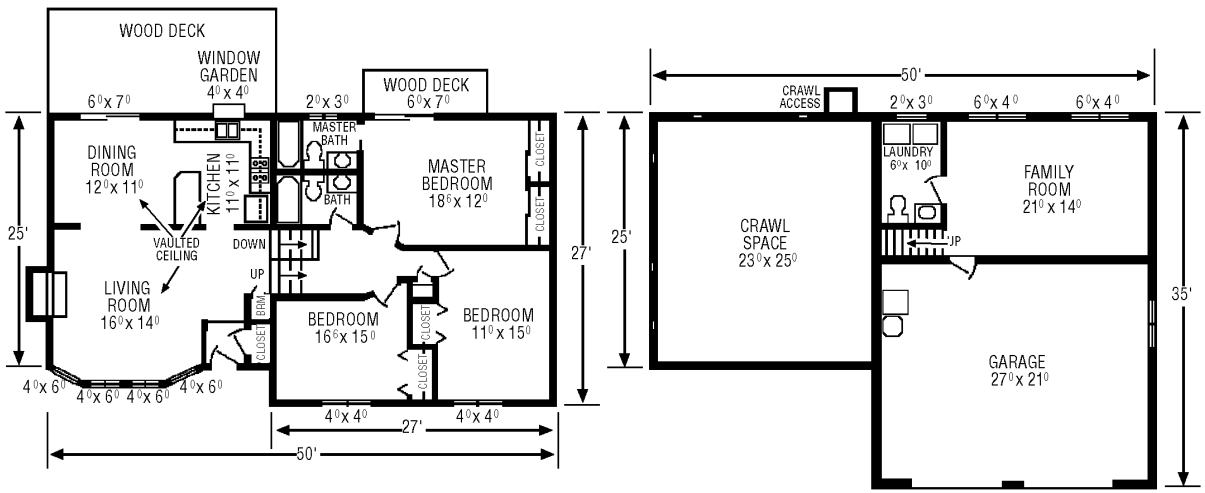

MECcheck Package Generator - Microsoft Internet Explorer
MECcheck
Package Generator
Building Information
Code: 1995 MEC, Single Family
HVAC: Unspecified
City: Andalusia, Alabama
Glazing Area: Up to 15.0% of wall
Print
Close
Sign In or Register (optional)
Registered members can save and recall project information. Registration is simple and free.
Sign in or register.
Step 3: Select Insulation and Window U-Factor Levels to Consider
Ceiling R- 19, 30, 38
Wall Cavity R- 11, 13
Wall Continuous R- 0
Window U- 0.40, 0.50, 0.65
Basement Wall R- 5, 7
Floor R- 11, 13, 19
Slab-on-Grade R- 0, 2
Crawl Space Wall R- No Crawl Wall
Step 2
Step 4: Generate Packages
Step 5: Choose From the Following Compliant Packages. Click to Generate a Compliance Report.
Ceiling | Wall Cavity | Wall Continuous | Window | Basement Wall | Floor | Slab-on-Grade
1. R-30 | R-13 | R-0 | U-0.65 | R-7 | R-11 | R-0
2. R-38 | R-11 | R-0 | U-0.65 | R-7 | R-13 | R-0
3. R-19 | R-13 | R-0 | U-0.50 | R-5 | R-11 | R-0
Done
Local intranet

Problem:

Determine compliance for the following single family residence

Prescriptive Package Approach



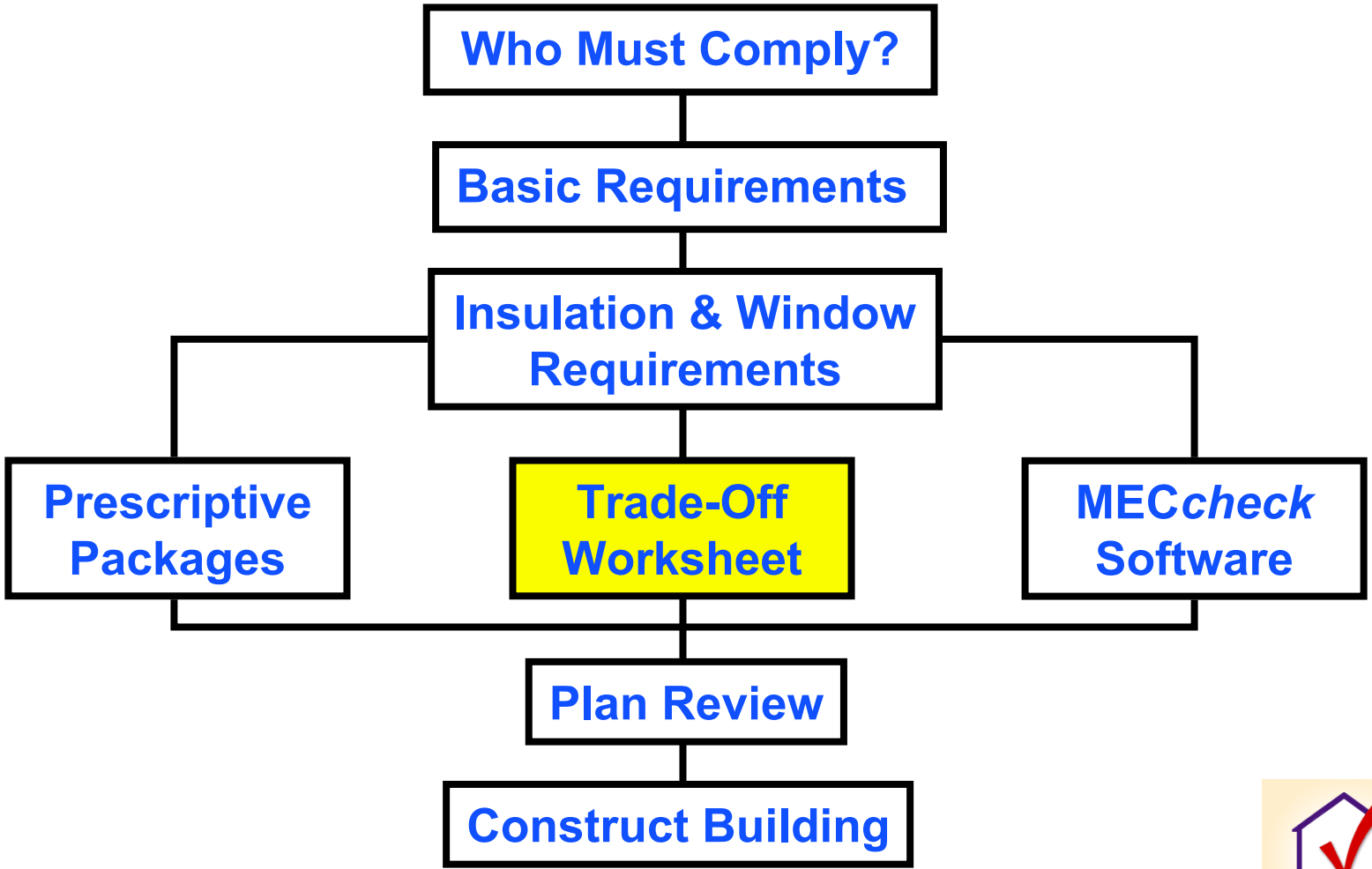


Prescriptive Package Approach

Example House Specifications

Building Component	Area (ft^2)	Insulation Level
Ceilings		
With Attic	729	R-38
Cathedral	592	R-30
Exterior Walls	276 Gross	R-13
2” x 4” @ 16” O.C.	1647 Gross	R-19 (R-13 Cavity & R-6 Sheathing)
Windows	204	U-0.38
Sliding Glass Doors	84	U-0.43
Doors		
Entrance	20	U-0.54
Garage to Family Room	18	U-0.35
Floors		
Over Garage	363	R-19
Over Crawl Space	575	R-19
Over Outside Air	24	R-30
Slab-On-Grade (unheated)	378 (55 perimeter ft.)	R-8
Heating Efficiency		High

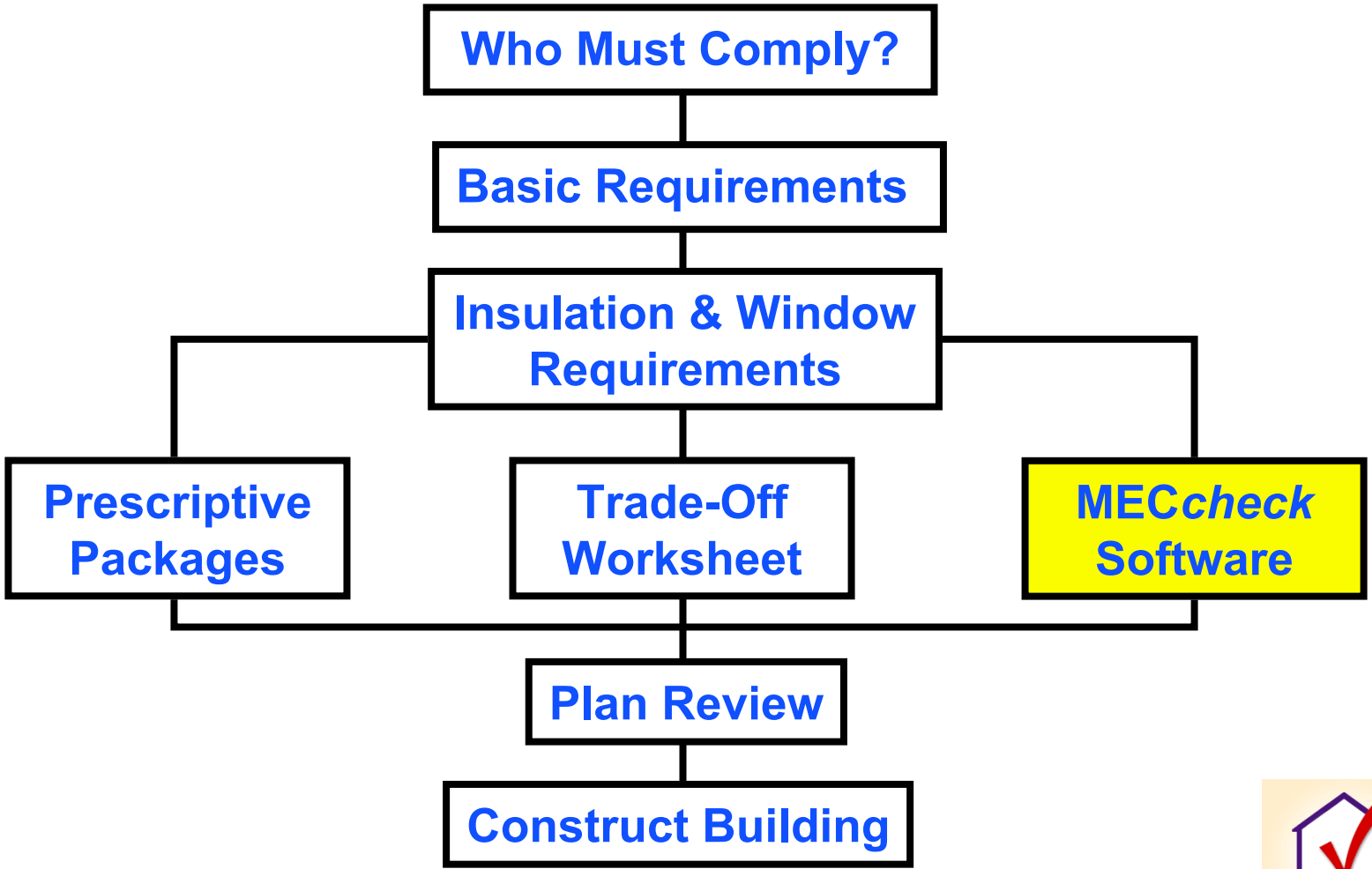
Compliance Path



Trade-Off Worksheet

- Overview
  - Allows for trade-offs between all thermal envelope components
  - Allows for multiple ceiling, wall, floor and window types
  - Compliance when Proposed House UA ≤ Required House UA

Compliance Path



MEC*check*™ Software

- Software evaluates specific designs quickly
- Allows trade-offs
  - Building envelope components
  - Heating and cooling efficiencies

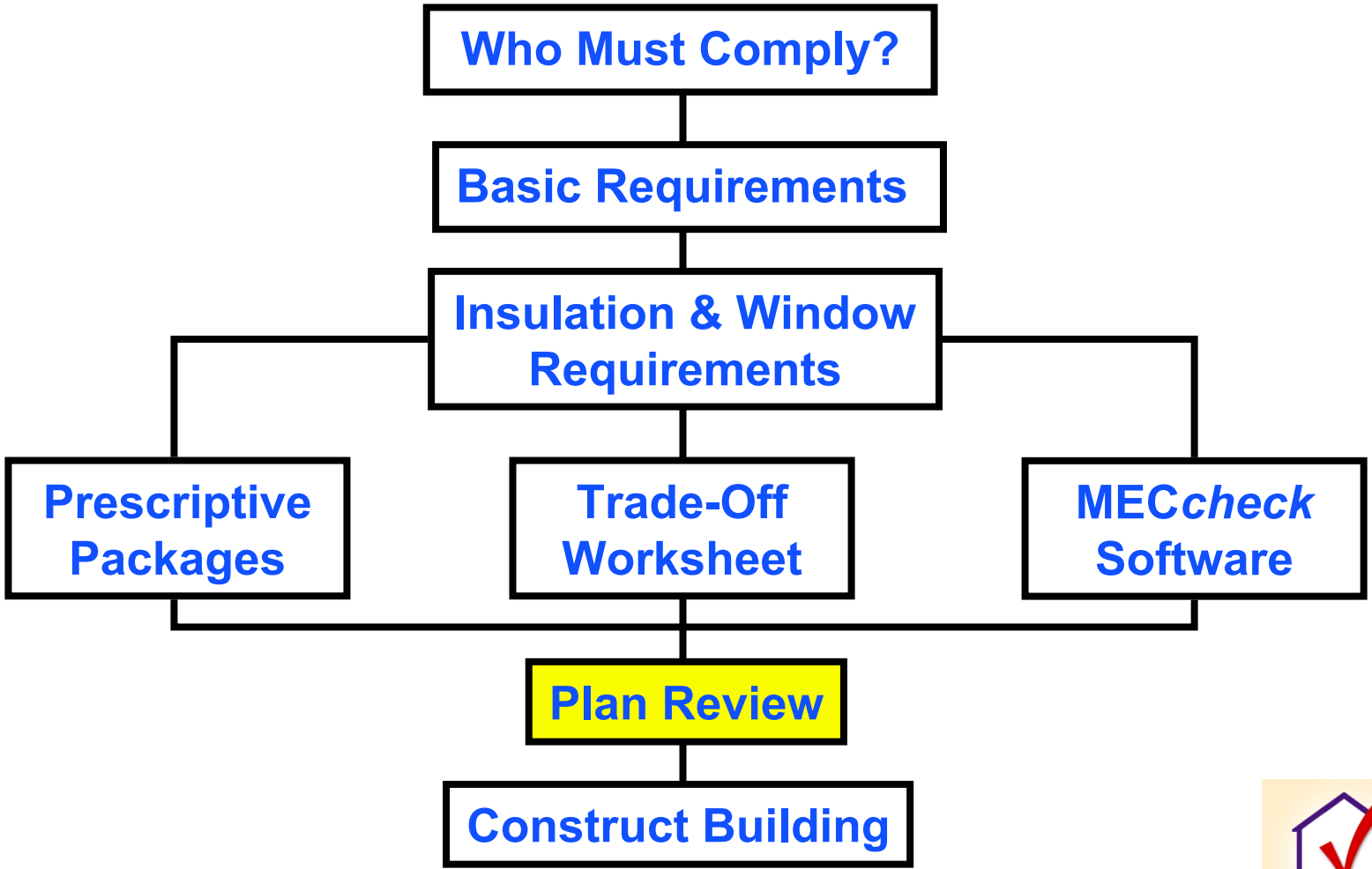
Computer Requirements

- Windows-based computer (PC)
  - 80486 processor
  - 6 MB extended RAM
  - 2MB free hard disk space
  - VGA or Super VGA monitor
  - Microsoft-compatible mouse (recommended)
  - Windows® 95, 98, 2000 or NT

Software Steps

- Choose your building location and whether it is a single-family or multifamily building
- Select the code year from the Options menu
- Create a building description
  - Enter building component information
- Add a high-efficiency equipment trade-off (if applicable)
- Save your building description and create a report

Compliance Path



Plan Check

- Verify plans comply with basic requirements
- Verify plans comply with insulation and window requirements
- Initiate Field Inspection Checklist

Field Inspection

- Foundation inspection
- Framing inspection
- Insulation inspection
- Final inspection